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ABSTRACT

This document, which is intended for use by community and junior colleges throughout Mississippi, contains curriculum frameworks for the course sequences in the machine tool operation/machine tool and tool and die making technology programs cluster. Presented in the introductory section are a framework of courses and programs, description of the program and suggested course sequences. Section I lists baseline competencies, and section II consists of outlines for each course in the sequence. Machine tool operation/machine shop technology courses are as follows: advanced shop mathematics, blueprint reading, power machinery I-II, precision layout, advanced blueprint reading, power machinery III-IV, computer numerical control (CNC) operations I-II, metallurgy, special problem, and work-based learning. Tool and die making technology courses include the following: fundamentals of die making; die repair; die design I; die making I; die design II; die making III-IV; CNC operations III; jigs, fixtures, and tools; special problem; and work-based learning. Also included are related vocational-technical courses (fundamentals of drafting, systems programming I, fundamentals of microcomputer applications, principles of computer-assisted design, descriptive geometry, and quality assurance) and a related academic course, trigonometry. Each course has been written using a common format which includes the following components: course name, course abbreviation, classification, description (main purpose of the course and recommended number of hours of lecture and laboratory activities), prerequisites, and competencies and suggested objectives. Recommended tools and equipment are listed in section III. Appended are lists of related academic topics and workplace skills for the 21st century and student competency profiles. (YLB)

Mississippi Curriculum Framework for Machine Tool Operation/Machine Shop and Tool and Die Making Technology

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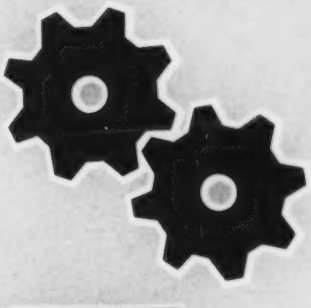

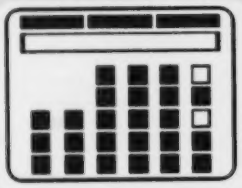

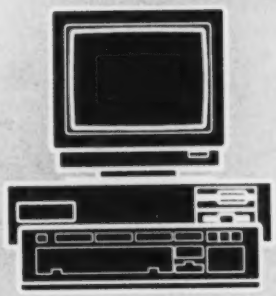

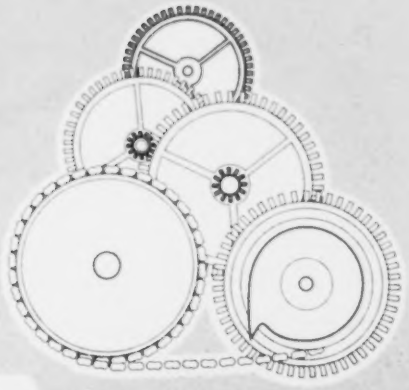

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1996

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July 30, 1996

MISSISSIPPI

CURRICULUM FRAMEWORK

FOR

MACHINE TOOL OPERATION/MACHINE SHOP AND TOOL AND DIE MAKING TECHNOLOGY CLUSTER

(Program CIP: 48.0507 - Tool and Die Maker/Technologist)
(Program CIP: 48.0503 - Machine Shop Assistant)

POSTSECONDARY PROGRAMS 1996

July 30, 1996

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FOREWORD

In order to survive in today's global economy, businesses and industries have had to adopt new practices and procedures. Total quality management, statistical process control, participatory management, and other concepts of high performance work organizations are practices by which successful companies survive. Employers now expect their employees to be able to read, write, and communicate effectively; solve problems and make decisions; and interact with the technologies that are prevalent in today's workplace. Vocational-technical education programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact on local vocational-technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and vocational skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U. S. Departments of Education and Labor, provide vocational educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses which focus on the development of occupational competencies. Each vocational-technical course in this sequence has been written using a common format which includes the following components:

- Course Name - A common name that will be used by all community/junior colleges in reporting students.
- Course Abbreviation - A common abbreviation that will be used by all community/junior colleges in reporting students.
- Classification - Courses may be classified as:
  - Vocational-technical core - A required vocational-technical course for all students.
  - Vocational-technical elective - An elective vocational-technical course.
  - Related academic course - An academic course which provides academic skills and knowledge directly related to the program area.
  - Academic core - An academic course which is required as part of the requirements for an Associate degree.
- Description - A short narrative which includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester.

- Prerequisites - A listing of any prerequisite courses that must be taken prior to or on enrollment in the course.
- Competencies and Suggested Objectives - A listing of the competencies (major concepts and performances) and of the suggested student objectives that will enable students to demonstrate mastery of these competencies.

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75 percent of the time allocated to each course. For example, in a four semester hour course consisting of 30 hours lecture and 120 hours of laboratory activities, approximately 22 hours of lecture and 90 hours of lab should be taken by the competencies and suggested objectives identified in the course framework. The remaining 25 percent of each course should be developed at the local district level and may reflect:
  - Additional competencies and objectives within the course related to topics not found in the State framework, including activities related to specific needs of industries in the community college district.
  - Activities which develop a higher level of mastery on the existing competencies and suggested objectives.
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed/revised.
  - Activities which implement components of the Mississippi Tech Prep initiative, including integration of academic and vocational-technical skills and coursework, school-to-career transition activities, and articulation of secondary and postsecondary vocational-technical programs.
  - Individualized learning activities, including worksite learning activities, to better prepare individuals in the courses for their chosen occupational area.

- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15 semester credit hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:

- 3 semester credit hours — Math Science Elective
- 3 semester credit hours — Written Communications Elective
- 3 semester credit hours — Oral Communications Elective
- 3 semester credit hours — Humanities/Fine Arts Elective
- 3 semester credit hours — Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic and vocational-technical courses each semester. Each community/junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- In instances where secondary programs are directly related to community and junior college programs, competencies and suggested objectives from the high school programs are listed as Baseline Competencies. These competencies and objectives reflect skills and knowledge that are directly related to the community and junior college vocational-technical program. In adopting the curriculum framework, each community and junior college is asked to give assurances that:
  - students who can demonstrate mastery of the Baseline Competencies do not receive duplicate instruction, and
  - students who cannot demonstrate mastery of this content will be given the opportunity to do so.

- The roles of the Baseline Competencies are to:
  - Assist community/junior college personnel in developing articulation agreements with high schools, and
  - Ensure that all community and junior college courses provide a higher level of instruction than their secondary counterparts

- The Baseline Competencies may be taught as special "Introduction" courses for 3-6 semester hours of institutional credit which will not count toward Associate degree requirements. Community and junior colleges may choose to integrate the Baseline Competencies into ongoing courses in lieu of offering the "Introduction" courses or may offer the competencies through special projects or individualized instruction methods.

- Technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

July 30, 1996

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MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

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FRAMEWORK OF COURSES AND PROGRAMS

Courses: (X = Required Course, E = Elective)	MTO	TAD
MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY COURSES		
Advanced Shop Mathematics	X	
Blueprint Reading	X	
Power Machinery I	X	
Power Machinery II	X	
Precision Layout	X	
Advanced Blueprint Reading	X	
Power Machinery III	X	
Computer Numerical Control Operations I	X	X
Power Machinery IV	X	
Computer Numerical Control Operations II	X	X
Metallurgy	E	E
Special Problem in Machine Tool Operation/ Machine Shop Technology	E	
Work-Based Learning in Machine Tool Operation/ Machine Shop Technology	E	
TOOL AND DIE MAKING TECHNOLOGY COURSES		
Die Repair		X
Die Design I		X
Fundamentals of Die Making		X
Die Design II		X
Die Making I		X
Die Making II		X
Die Making III		X
Computer Numerical Control Operations III		X
Special Problem in Tool and Die Making Technology		E
Jigs, Fixtures, and Tools		E
Work-based Learning in Tool and Die Making Technology		E
RELATED VOCATIONAL-TECHNICAL COURSES		
Fundamentals of Drafting	E	X
Principles of CAD	E	X
Quality Assurance	E	E
Descriptive Geometry	E	E
Computer Fundamentals for Electronics/Electricity		E
Fundamentals of Microcomputer Applications	E	E

RELATED ACADEMIC COURSES

Trigonometry E

MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

PROGRAM DESCRIPTION

Machine Tool Operation/Machine Shop Technology is an instructional program that prepares individuals to shape metal parts on machines such as lathes, grinders, drill presses, and milling machines. Included is instruction in making computations related to work dimensions, testing, feeds, and speeds of machines; using precision measuring instruments such as layout tools, micrometers, and gauges; machining and heat-treating various metals; and laying out machine parts. Also included is instruction in the operation and maintenance of computerized equipment.

Postsecondary Machine Tool Operation/Machine Shop Technology is an articulated certificate-technical program designed to provide advanced skills to its students. Entry into the postsecondary program is based upon mastery of Baseline Competencies which are taught in the secondary programs. Students who do not possess such skills must complete additional coursework in order to graduate from the program. The certificate program consists of instruction in Baseline Competencies which may be obtained in a secondary metal trades program or at the community college and two semesters of advanced skill training which must be obtained at the community college level. Students desiring an Associate of Applied Science degree in the technical program must complete an additional two semesters of coursework including the academic core.

The uniform program structure for postsecondary Machine Tool Operation/Machine Shop Technology is designed to serve as the core of instruction for approximately seventy-five percent of each major machine tool operation course at the postsecondary level. The remaining twenty-five percent of each course is to be added at the local level based upon needs of students and local employers.

ONE-YEAR CERTIFICATE OF MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

SUGGESTED COURSE SEQUENCE*

Baseline Competencies for Postsecondary
Machine Tool Operation/Machine Shop and Tool and Die Making
Technology Cluster**

FIRST YEAR

3 sch	Advanced Shop Mathematics (MST 1313)	7 sch	Power Machinery II (MST 1127)
3 sch	Blueprint Reading (MST 1413)	3 sch	Precision Layout (MST 1613)
7 sch	Power Machinery I (MST 1117)	3 sch	Advanced Blueprint Reading (MST 1423)
3 sch	Vocational Elective†	3 sch	Vocational Elective†
16 sch		16 sch	

* Students who lack entry level skills in math, English, science, etc. will be provided related studies.

** Baseline competencies are taken from the high school Metal Trades program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

† Vocational Electives
Metallurgy (MST 2812)
Quality Assurance (DDT 2263)
Descriptive Geometry (DDT 1153)
Fundamentals of Microcomputer Applications (CPT 1113)
Principles of CAD (DDT 1114)
Work-Based Learning in Machine Tool Operation/Machine Shop Technology (MST 291[1-6])
Special Problem in Machine Tool Operation/Machine Shop Technology (MST 292[1-3])

TWO-YEAR CERTIFICATE OF MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

SUGGESTED COURSE SEQUENCE*

Baseline Competencies for Postsecondary
Machine Tool Operation/Machine Shop and Tool and Die Making
Technology Cluster**

FIRST YEAR

3 sch	Advanced Shop Mathematics (MST 1313)	7 sch	Power Machinery II (MST 1127)
3 sch	Blueprint Reading (MST 1413)	3 sch	Precision Layout (MST 1613)
7 sch	Power Machinery I (MST 1117)	3 sch	Advanced Blueprint Reading (MST 1423)
3 sch	Vocational Elective†	3 sch	Vocational Elective†
16 sch		16 sch	

SECOND YEAR

5 sch	Power Machinery III (MST 2135)	4 sch	Power Machinery IV (MST 2144)
4 sch	Computer Numerical Control Operations I (MST 2714)	5 sch	Computer Numerical Control Operations II (MST 2725)
3 sch	Vocational Elective†	3 sch	Vocational Elective†
3 sch	Vocational Elective†	3 sch	Vocational Elective†
15 sch		15 sch	

* Students who lack entry level skills in math, English, science, etc. will be provided related studies.

** Baseline competencies are taken from the high school Metal Trades program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

Vocational Electives
Metallurgy (MST 2812)
Quality Assurance (DDT 2263)
Descriptive Geometry (DDT 1153)
Fundamentals of Microcomputer Applications (CPT 1113)
Principles of CAD (DDT 1114)
Work-Based Learning in Machine Tool Operation/Machine Shop Technology (MST 291[1-6])
Special Problem in Machine Tool Operation/Machine Shop Technology (MST 292[1-3])

MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

SUGGESTED COURSE SEQUENCE*

Baseline Competencies for Postsecondary
Machine Tool Operation/Machine Shop and Tool and Die Making
Technology Cluster**

FIRST YEAR

3 sch	Advanced Shop Mathematics (MST 1313)	7 sch	Power Machinery II (MST 1127)
3 sch	Blueprint Reading (MST 1413)	3 sch	Precision Layout (MST 1613)
7 sch	Power Machinery I (MST 1117)	3 sch	Advanced Blueprint Reading (MST 1423)
3 sch	Written Communications Elective	3 sch.	Math/Science Elective
16 sch		16 sch	

SECOND YEAR

3 sch	Elective	4 sch	Power Machinery IV (MST 2144)
5 sch	Power Machinery III (MST 2135)	5 sch	Computer Numerical Control Operations II (MST 2725)
4 sch	Computer Numerical Control Operations I (MST 2714)	2 sch	Technical Elective
3 sch	Humanities/Fine Arts Elective	3 sch	Oral Communications Elective
15 sch		3 sch	Social/Behavioral Science Elective
		17 sch	

* Students who lack entry level skills in math, English, science, etc. will be provided related studies.

** Baseline competencies are taken from the high school Metal Trades program. Students who can document mastery of these competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

VOCATIONAL-TECHNICAL ELECTIVES
Metallurgy (MST 2812)
Quality Assurance (DDT 2263)
Descriptive Geometry (DDT 1153)
Fundamentals of Microcomputer Applications (CPT 1113)
Principles of CAD (DDT 1313)
Fundamentals of Drafting (DDT 1114)
Work-Based Learning in Machine Tool Operation/Machine Shop Technology (MST 291[1-6])
Special Problem in Machine Tool Operation/Machine Shop Technology (MST 292[1-3])

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TOOL AND DIE MAKING TECHNOLOGY

PROGRAM DESCRIPTION

This is an instructional program that prepares individuals to analyze specifications and lay out metal stock and to set up and operate machine tools to fit and assemble parts for the manufacture and repair of metalworking dies, cutting tools, fixtures, gauges, and machinist's hand tools. Included is instruction in metal properties and in the applications and construction of tool and die designs.

Postsecondary Tool and Die Making Technology is an articulated program designed to provide advanced and technical skills to its students. Entry into the postsecondary program is based upon mastery of Baseline Competencies which are taught in the secondary programs. Students who do not possess such skills must complete additional coursework in order to graduate from the program. A student successfully completing the technical program will receive an Associate degree.

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TOOL AND DIE MAKING TECHNOLOGY

SUGGESTED COURSE SEQUENCE*

Baseline Competencies for Postsecondary Machine Tool Operation/Machine Shop and Tool Die Making Technology Cluster**

FIRST YEAR

3 sch	Fundamentals of Die Making (TDT 1113)	3 sch	Die Design I (TDT 1133)
3 sch	Die Repair (TDT 1123)	4 sch	Die Making ! (TDT 1144)
3 sch	Fundamentals of Drafting (DDT 1113)	4 sch	Computer Numerical Control Operations I (MST 2714)
3 sch	Technical Elective	3 sch	Written Communication Elective
3 sch	Math/Science Elective	3 sch	Principles of CAD (DDT 1313)
15 sch		17 sch	

SECOND YEAR

3 sch	Die Design II (TDT 2153)	4 sch	Die Making III (TDT 2174)
4 sch	Die Making II (TDT 2164)	3 sch	Computer Numerical Control Operations III (TDT 2233)
5 sch	Computer Numerical Control Operation II (MST 2725)	1-6 sch	Technical Elective
3 sch	Technical Elective	3 sch	Social/Behavioral Science Elective
3 sch	Oral Communication Elective	3 sch	Humanities/ Fine Arts Elective
18 sch		19 sch	

* Students who lack entry level skills in math, English, science, etc. will be provided related studies.

** Baseline competencies are taken from the high school Metal Trades Program. Students who can document mastery of this competencies should not receive duplicate instruction. Students who cannot demonstrate mastery will be required to do so.

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VOCATIONAL-TECHNICAL ELECTIVES

Metallurgy (MST 2812)
Quality Assurance (DDT 2263)
Jigs, Fixtures, and Tools (TDT 2183)
Descriptive Geometry (DDT 1153)
Trigonometry (MAT 1323)
Computer Fundamentals for Electronics/Electricity (EET 1613)
Fundamentals of Microcomputer Applications (CPT 1113)
Special Problem in Tool and Die Making Technology (TDT 291[1-3])
Work-Based Learning in Tool and Die Making Technology (TDT 292[1-6])

SECTION I:

BASELINE COMPETENCIES

BASELINE COMPETENCIES FOR MACHINE TOOL OPERATION/MACHINE SHOP AND TOOL & DIE MAKING TECHNOLOGY CLUSTER

The following competencies and suggested objectives are taken from the publication *Mississippi Curriculum Framework for Metal Trades*. These competencies and objectives represent the baseline which was used to develop the community/junior college Machine Tool Operation/Machine Shop and Tool & Die Making Technology courses. Students enrolled in postsecondary courses should either (1) have documented mastery of these competencies, or (2) be provided with these competencies before studying the advanced competencies in the Machine Tool Operation/Machine Shop and Tool & Die Making programs.

Baseline competencies may be integrated into existing courses in the curriculum or taught as special "Introduction" course. The "Introduction" courses may be taught for up tc six semester hours of institutional credit and may be divided into two courses each course should be at least 3 credit hours. The following course number(s) and description should be used:

Course Name(s): Introduction to Machine Tool Operation/Machine Shop and Tool and Die Making Technology Cluster, Machine Tool Operation/Machine Shop and Tool and Die Making Technology I, or Machine Tool Operation/Machine Shop and Tool and Die Making Technology II

Course Abbreviations(s): MST 1003, MST 1013, MST 1023

Classification: Vocational-Technical Core

Description: These courses contain the baseline competencies and suggested objectives for the high school Metal Trades curriculum which directly relate to the community college Machine Tool Operation/Machine Shop and Tool and Die Making Technology programs. The courses are designed for students entering the community college who have had no previous training or documented experience in the field. (3-6 semester hours based up on existing skills for each student. May be divided into 2 courses for a maximum total of 6 hours of institutional credit.)

Competencies and Suggested Objectives:

1. Demonstrate the student school handbook and classroom policies.
   a. Identify policies found in the school handbook.
   b. Identify classroom rules and policies.
   Related Academic Topics (See Appendix A): C1, C2, C3
   Workplace Skills (See Appendix B): WP2, WP6

2. Review occupational and leadership opportunities in metal trades.
   a. Investigate occupational opportunities in the local area.
   b. Update the student's Career/Educational Plan.
   c. Describe leadership opportunities available from student youth organizations in the school and community, including VICA.

   Related Academic Topics (See Appendix A): C1, C4, C6
   Workplace Skills (See Appendix B): WP2, WP3, WP6
3. Demonstrate safety procedures used in metal trades.
   a. Apply safety rules for personal and general shop safety including eye (State Eye Safety Law provisions), ear, and body protection; general rules of shop conduct; and the use of safety color coding in metal trades.
   b. Apply general safety rules for tool and shop equipment use including use of hand tools, air and electric power tools, and other shop equipment.
   c. Apply rules and procedures associated with fire safety including procedures for handling and storing flammable liquids and proper use of fire fighting devices.

   Related Academic Topics (See Appendix A): C2, C4, S5, S6, S8
   Workplace Skills (See Appendix B): WP5
4. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.
   a. Recognize signal words and symbols that indicate severity of a hazard.
   b. Describe methods for reducing hazardous waste.
   c. Describe procedures for storing hazardous waste.
   d. Interpret data found on a hazardous material safety data sheet.
   e. Describe general safety procedures for first aid and cleanup to follow in case of an accident involving hazardous materials.
   f. Demonstrate procedures for handling, storing, and disposing of hazardous materials as per current federal and state guidelines.

   Related Academic Topics (See Appendix A): C1, C2, C4, S5, S8
   Workplace Skills (See Appendix B): WP2, WP3, WP4, WP5, WP6
5. Calculate measurements using fractions and decimals.
   a. Solve problems using fractions including conversion for performing addition, subtraction, multiplication, and division.
   b. Solve problems using decimals, including the addition, subtraction, multiplication, and division of decimal numbers.

   Related Academic Topics (See Appendix A): C1, C5, M1, M4, M7
   Workplace Skills (See Appendix B): WP1, WP2, WP6
6. Inspect a machined part as per specifications with various instruments.
   a. Measure a three dimensional part with a steel rule to the nearest 1/32 inch.
   b. Measure a workpiece with a combination set to lay out lines to the nearest 1/32 inch and angles to the nearest degree, and find the center of a round part.

c. Measure various workpieces with a micrometer, outside vernier micrometer, and depth micrometer, using vernier and digital scales, to the nearest 0.001 inch.
d. Distinguish between materials used in the metal trades, including ferrous, non-ferrous, and non-metallic materials.

Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M3, S4
Workplace Skills (See Appendix B): WP1, WP2, WP6

7. Interpret blueprint symbols, abbreviations, alphabet of lines, types of views, and title blocks.
   a. Identify the meaning of common blueprint symbols including concentricity, straightness, perpendicularity, center line, and diameter.
   b. Describe the abbreviations commonly used on blueprints including the following: Cast iron (CI), Cold rolled steel (CRS), Cast steel (CS), Center to center (CC), Counterbore (C' Bore or CB), Countersink (Csk), Diameter (Dia), Finish (F or Fin), Square (SQ), Hexagon (Hex), Inside diameter (ID), Outside diameter (OD), Radius (R or Rad), Required (Req'd or Req), Pitch diameter (PD), Round (Rd), Symmetrical (SYM), Total indicator reading (TIR), Typical (TYP), Parallel (Par), United National Coarse (UNC), Unified National Fine (UNF), and American Standard Taper Pipe (NTP).
   c. Identify the alphabet of lines used on blueprints, including object lines, hidden lines, center line, extension line, dimension lines, section lines, cutting plane line, break lines, and phantom line.
   d. Identify the types of views shown on blueprints including top, front, and right side.
   e. Define the terms "dimension" including size, shape, location, and slots, and "tolerance" including the total variation permitted in the size of a part.
   f. Identify methods for showing dimensions and tolerance including linear and angular dimensions and basic size, allowance, and actual size tolerance.
   g. Interpret information found in the title block of a blueprint including drawing number, file number, name, sheet, scale, code identification number, signatures, tolerances, and revisions.

   Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M4
   Workplace Skills (See Appendix B): WP1, WP2, WP6

8. Identify and describe hand tools and their safe use.
   a. Identify and describe rules for the safe use and care of common hand tools including machinist's vise, wrenches, pliers, files, screwdrivers, chisels, hacksaws, and hammers.
   b. Describe reasons for tap failure including wrong size tap, wrong size tap drill, dull tap, incorrectly aligned tap, tap wrench too large, bottoming out in blind hole, incorrect lubrication, and incorrect chip removal procedure.

c. Determine the proper size tap drill by using a tap chart and identify thread forms including American National Thread and ACME.

Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, M3, S5, S6
Workplace Skills (See Appendix B): WP1, WP2, WP3

9. Lay out and fabricate a given project using the combination square.
   a. Fabricate a project by performing layout using a combination square, cutting out using a saw, and filing to specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, M3, S5, S6
Workplace Skills (See Appendix B): WP1, WP2, WP3

10. Identify and describe the safe operation of the types of power saws to include care, cleaning, use, and performance of cutting operations.
   a. Identify and describe rules for safe use of power saws including adjustment of guide to thickness of material, use of pusher, and application of correct feed pressure, for different types of power saws, including vertical, horizontal, cut-off, and reciprocating.
   b. Describe factors that determine saw blade selection including type of material, thickness of material, and type of job, and examine chart and speed formula methods for determining band saw speeds for cutting different materials.
   c. Describe factors to consider in the care and cleaning of power saws including removal of chips with a brush, wiping the table with an oily rag, lubricating, checking guides, adjusting guides according to manufacturer's specifications, and coiling and uncoiling a band saw blade according to accepted industry standards.
   d. Lay out and cut stock with a band saw according to specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, M3, S5, S6
Workplace Skills (See Appendix B): WP1, WP2, WP3

11. Identify and describe the types of drilling machines, hand powered and drill press, and the rules for safe operation of each.
   a. Describe safety rules for the safe use of a hand power drill and drill press including clamping down work, wearing safety goggles, setting speed correctly, securing adapter in the spindle, removing chuck key from chuck, changing variable speed only when drill press motor is running, and reducing drill pressure upon point breakthrough.
   b. Identify work-holding and setup devices in drill press operations including vise, V-blocks, and hold-down clamps.
   c. Lay out holes and drill, ream, countersink, and counterbore according to project specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, M3, S5, S6
Workplace Skills (See Appendix B): WP1, WP2, WP3

12. Identify and describe the basic equipment, setup, and safety rules for proper use of oxyacetylene equipment.
   a. Identify and describe safety rules and instructions for using oxyacetylene equipment including protective equipment such as goggles and gloves;

safety clothing requirements; clearing of work area; oxyacetylene cylinders and gases; adjusting pressure regulator valves; and care of welding hoses, torch body, cutting torch, welding tips, and spark striker.

b. Set up oxyacetylene welding and cutting equipment including securing cylinders to hand truck or wall; removing cylinder valve caps; examining cylinder valve threads for damage and wiping clean of dust, oil, or grease with a clean dry cloth; purging cylinder valves; installing regulators; installing hoses; and installing torch body and welding/cutting tips.

c. Prepare oxyacetylene equipment for welding, cutting, and brazing including adjustment of regulator pressure, lighting of torch, and adjustment of flame; define the terms "backfire" and "flashback"; and state possible causes of flashback including failure to purge equipment, leaks from loose tips or tip nuts, incorrect gas pressure, tip held too close to work, insufficient volume of oxygen or acetylene, and using tip in confined area.

d. Distinguish between fusion welding and brazing and the purpose of flux.

Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, S5, S6
Workplace Skills (See Appendix B): WP2, WP5, WP6

13. Perform welding, cutting, and brazing operations with oxyacetylene equipment.

    a. Lay beads on a flat plate with and without filler rod including puddle control according to industry standards, and weld an outside corner joint in the flat position including puddle control and metal fusion.

    b. Make 90-degree cuts on mild steel including control and handling of equipment according to industry standards, and braze weld a square groove butt joint in the flat position including control of temperature of base metal and filler rod.

    Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, S5, S6
    Workplace Skills (See Appendix B): WP2, WP5, WP6

14. Identify and describe procedures and processes for SMAW.

    a. Explain safety rules related to SMAW equipment and processes including electrical safety, handling of welding cables and containers, hazards of arc rays, protective clothing, and environmental safety requirements.

    b. Describe how flux-covered electrodes work including design of the metal core with flux coating, contribution of metal to the weld, and shielding to prevent oxidation; explain the meaning of the numbers in the AWS electrode code classification including prefix, tensile strength, position, and special characteristics; and identify welding symbols.

    c. Describe the basic elements and techniques of arc welding including electrode selection, welding speed, welding position, joint preparation, fit-up, polarity, striking and maintaining an arc, arc gap, operating speed, electrode angle, movement of electrode, and the characteristics of good and bad welds by identifying the effects of current, voltage, and speed.

Related Academic Topics (See Appendix A): C1, C2, C3, M1, M2, M4, S5, S6
Workplace Skills (See Appendix B): WP1, WP2, WP4

15. Demonstrate proper striking and restriking of an electrode, controlling the crater, backfilling a bead, and building a pad.
    a. Strike and re-strike an arc, crater, and backfill a bead while running a bead on mild steel plate.
    b. Build a pad in the flat position on mild steel, and fabricate a butt joint and a multiple pass T-joint in flat and horizontal positions in mild steel according to specifications.

    Related Academic Topics (See Appendix A): S5
    Workplace Skills (See Appendix B): WP1, WP6
16. Identify and describe safety rules that apply to the pedestal grinder, and perform inspection, maintenance, and grinding operations.
    a. Describe safety rules that apply to the pedestal grinder including wearing safety glasses, standing to side when turning on machine, gap between wheel and rest, conducting ring test when installing wheel, and correct feed.
    b. Inspect and maintain a pedestal grinder including checking a new wheel for cracks, replacing a wheel, and dressing a wheel, and grinding a high speed tool bit and twist drill to specifications.

    Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M4, S4, S5
    Workplace Skills (See Appendix B): WP1, WP2, WP4
17. Identify and compare shapes of single-point, carbide, and high speed steel cutting tools. Perform a free-hand grinding of a turning tool, facing tool, and a 60-degree threading tool.
    a. Identify and compare basic shapes of single-point cutting tools including: right handed and left handed turning, right handed and left handed facing, threading and parting, carbide and high speed steel cutting tools including advantages and disadvantages of each.
    b. Free-hand grind a turning tool, facing tool, and 60-degree threading tool; and sharpen a cutoff tool blade to specifications.

    Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M4, S4, S5
    Workplace Skills (See Appendix B): WP1, WP2, WP4
18. Identify safety rules and components of an engine lathe, to include use of accessories, care and cleaning, basic operations, lathe speeds, and feeds.
    a. Describe rules for the safe use of an engine lathe including eye protection, guards, tools, care and cleaning, and hazards associated with clothing and jewelry.
    b. Identify the components of an engine lathe and the function of each part including head stock, tail stock, bed, carriage, and common lathe accessories and function of each including drill chuck, sleeve adapter, lathe dog, knurling tool, steady rest, follow rest, taper attachment, three-jaw universal chuck, four-jaw independent chuck, collet chuck with

drawbar and adapter, drive place, spindle adapter, dead center and live center, mandrill, micrometer carriage stop, pipe center, and face place.

c. Describe the basic operations performed on a lathe including threading, drilling, forming, shouldering, reaming, tapping, grooving, boring, center drilling, facing, cutoff, filing, turning, knurling, chamfering, polishing, and tapering. Determine lathe speeds and feeds using shop formulas and charts.

Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M4, M5, S4, S5

Workplace Skills (See Appendix B): WP1, WP2, WP4

19. Remove and install a lathe chuck, and perform lathe operations.
    a. Remove and install a lathe chuck following manufacturer's recommendations and perform a facing operation, face a part to length, perform a straight turning operation, turn a part with square shoulder to length, and perform a center-drilling operation according to layout specifications.
    b. Turn threads to specifications.

    Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M4, S4, S5

    Workplace Skills (See Appendix B): WP1, WP2, WP5

20. Identify and describe hand tools, sheet metal machines, and terms used in sheet metal work.
    a. Identify and describe the safe use of specialized hand tools and sheet metal working machines used in sheet metal work including: steel rule, dividers, squares, protractors, American and U.S. Standard metal gauges, metal marking devices, snips, punches, rivet sets, dollies, chisels, hammers, crimpers, hand seamer, dovetailer, files, hacksaw, screwdrivers, pliers, wrenches, pop rivet gun, and hand groover, adjustable bar folder, hand brake (cornice brake), box and pan brake, ring and circle shears, and notcher.
    b. Identify common seams, locks, edges, and notches used in sheet metal work including seams (groove lock, Pittsburgh, standing, soldered, and riveted); locks (drive cleat, S-cleat, standing S-cleat), edges (hem, double hem, standing hem, and wired edge), and notches (corner, lap, duct, 45-degree lap, center Pittsburgh, corner Pittsburgh, and dovetail); identify fasteners used in sheet metal work including rivets, screws, and bolts and nuts; and define basic geometric terms including parallel line layout, radial line, triangulation circumference, diameter, radius, pi, area, perimeter, and volume.

    Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M7

    Workplace Skills (See Appendix B): WP2, WP5

21. Fabricate sheet metal projects as assigned, using various hand tools and sheet metal machines.
    a. Fabricate metal rectangles, metal circles, form cylinders, a simple box, and straight duct to specifications; fabricate 90 degree (square throat and heel), 90 degree elbow (radius throat and heel), and simple offset.
    b. Fold, bend, hem, and make drive clips on a hand brake according to specifications.

    Related Academic Topics (See Appendix A): C1, C2, C5, M1, M2, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP5, WP6
22. Describe and identify safety precautions to be followed in using an engine lathe, methods for measuring thread pitch diameters, and calculation of dimensions using taper formulas.
    a. Describe safety precautions to be followed in using an engine lathe.
    b. Identify methods for measuring thread pitch diameters including micrometer and calipers.
    c. Calculate dimensions using taper formulas according to specifications.
    d. Obtain information from reference materials, such as the Machinist's Handbook.

    Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
23. Perform various engine lathe operations according to specifications.
    a. Perform the following operations using an engine lathe: chamfer, recessing, knurling, drill and recess a hole, align and start a tap using a lathe center, and cutoff.
    b. Perform the following turning and cutting operations using an engine lathe: turn between centers; turn a taper with taper attachment, turn a taper with compound, boring, cut external threads to relief, pick up threads, and cut internal threads.

    Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4, S5, S6
    Workplace Skills (See Appendix B): WP2, WP4, WP5
24. Describe and identify rules applying to milling machine safety; types of milling machines; major components of horizontal and vertical mills; work-holding devices, cutting tools, tool holders, and other attachments used with milling machines; and the different types of horizontal and vertical milling operations.
    a. Describe rules applying to milling machine safety including having safety guards in place, operating machines according to manufacturer's specifications, and wearing eye protection.
    b. Identify the types of milling machines including vertical and horizontal. Describe the major components of horizontal and vertical mills including base, head, table, saddle, and knee.
    c. Identify work-holding devices, cutting tools, tool holders, and other attachments used with milling machines including vises and holding clamps, end mill, and milling cutters.

d. Describe the different types of horizontal milling operations including key cutting, spline cutting, angle cutting, and slotting, and the different types of vertical milling machine operations including key cutting, spline cutting, angle cutting, boring, drilling, and slotting.

Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4
Workplace Skills (See Appendix B): WP2, WP4, WP5

25. Adjust horizontal milling machine speed and feed rates, clean and lubricate a horizontal mill, mount arbors and adjust arbor support bushing on a horizontal milling machine, mount a cutter to a horizontal milling machine arbor, mill a keyway, and perform selected horizontal milling operations.
    a. Adjust machine speed and feed rates, and clean and lubricate a horizontal mill.
    b. Mount arbors and adjust arbor support bushing on a horizontal milling machine, and mount a cutter to a horizontal milling machine arbor according to specifications.
    c. Perform selected horizontal milling operations according to specifications.

    Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4
    Workplace Skills (See Appendix B): WP2, WP4, WP5
26. Mount and remove cutters and cutter holders for vertical spindle milling machines, align a vise on a vertical milling machine using dial indicator, and perform selected vertical milling and boring operations.
    a. Mount and remove cutters and cutter holders for vertical spindle milling machines, and mount and align a vise on a vertical milling machine.
    b. Perform selected vertical milling and boring operations according to specifications.

    Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4
    Workplace Skills (See Appendix B): WP2, WP4, WP5
27. Describe safety procedures for grinding machine safety, magnetic chuck work, surface grinding operations, and reasons for truing and balancing a grinding wheel.
    a. Describe rules for grinding machine safety including standing to the right front side of the machine when in operation, having safety guards in place, conducting ring test when installing new grinding wheel, operating according to manufacturer's specifications, and wearing protective equipment.
    b. Describe safety rules that apply to magnetic chuck work including cleaning, deburring, and operating according to manufacturer's specifications.
    c. Identify surface grinding operations including grinding flat surfaces, edges, cut-off, slots, and angle surfaces.
    d. Explain reasons for truing and balancing grinding wheels including making wheel concentric, eliminating chatter marks, eliminating vibration, and removing glazing.

Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4
Workplace Skills (See Appendix B): WP2, WP4, WP5

28. Perform maintenance operations on a bench grinder to manufacturer's specifications and grinding operations to teacher's specifications.
    a. Remove and replace a grinding wheel on a grinding machine according to manufacturer's specifications.
    b. Dress a grinding machine wheel flat according to manufacturer's specifications.
    c. Grind a workpiece flat and parallel according to manufacturer's specifications. Grind a workpiece square, an angular surface, and to dimension according to teacher's specifications.

    Related Academic Topics (See Appendix A): C1, C2, C6, M1, M2, M4
    Workplace Skills (See Appendix B): WP2, WP4, WP5

SECTION II:

CURRICULUM GUIDE

FOR

MACHINE TOOL OPERATION/MACHINE SHOP AND TOOL AND DIE MAKING
TECHNOLOGY CLUSTER

MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY COURSES

Course Name: Advanced Shop Mathematics

Course Abbreviation: MST 1313

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: An applied mathematics course designed for machinists. Includes instruction and practice in algebraic and trigonometric operations essential for successful machining. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Solve mathematical problems relating to machine shop activities.
   a. Set up formulas and solve reading problems as applied to machine shop applications.
   b. Transpose components of algebraic formulas to machine shop applications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Describe and apply trigonometric functions.
   a. Describe the trigonometric functions and state their relationship to the sides and angles of a triangle.
   b. Use the trigonometric functions to solve for unknown sides and angles of a triangle.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6,
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Identify properties of a circle and solve mathematical problems relating to the properties, and calculate area and volume for geometric objects.
   a. Identify the properties of a circle and solve problems relating to these properties, including: radius, diameter, circumference, and area, as applied to machine shop operations.
   b. Calculate area and volume for various geometrically shaped objects including cubes, pyramids, spheres, prisms, and cylinders, as applied to machine operations.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

July 30, 1996

Course Name: Blueprint Reading

Course Abbreviation: MST 1413

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: A course in blueprint reading designed for machinists. Includes instruction and practice in reading and applying industrial blueprints. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Identify, describe, and apply dimensions and tolerances related to blueprints.
   a. Identify, describe, and apply industrial methods for showing dimensions and tolerances.
   b. Describe and apply the International System of Units (SI) as used in blueprints.
   c. Describe and apply the need for metric dimensioning.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Identify, describe, and apply auxiliary views, finishes, materials, section lines, and cutting plane lines.
   a. Identify, distinguish, and apply primary and secondary auxiliary views on a drawing.
   b. Identify, describe, and apply surface finishes shown on a blueprint.
   c. Identify materials used as indicated by section lines, and demonstrate correct selection.
   d. Describe and apply the use of the cutting plane line.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Power Machinery I

Course Abbreviation: MST 1117

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: A course in the operation of power machinery. Includes instruction and practice in the operation of lathes, drill presses, and vertical mills. (7 sch: 2 hr. lecture, 10 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Perform drilling operations.
   a. Tap holes using a drill press according to project specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Perform turning, boring, and cutting operations.
   a. Use shop formulas and charts to determine lathe speed and feed rates, and make application to production according to project specifications.
   b. Use an engine lathe to turn a taper with compound to project specifications.
   c. Use an engine lathe to perform boring operations according to project specifications.
   d. Use an engine lathe to cut internal and external threads to class 2 specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7,S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Mount a swivel based vise and perform milling and boring operations.
   a. Mount and align a swivel-base vise on a vertical mill using a dial indicator.
   b. Perform selected vertical milling and boring operations according to project specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
4. Perform project layout and use various precision instruments.
   a. Perform project layout using various precision squares.
   b. Perform measurements with a vernier micrometer to within .0001 of an inch.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

5. Calculate bandsaw blade length, fabricate a bandsaw blade, and install the blade on a bandsaw.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP1, WP2, WP3, WP4, WP5, WP6
6. Identify, calculate, and fabricate threads to instructor's specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
7. List and describe the proper sequence for planning a job.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

July 30, 1996

Course Name: Power Machinery II

Course Abbreviation: MST 1127

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: A continuation of Power Machinery I with emphasis on more advanced applications of lathes, mills, shapers, and precision grinders. (7 sch: 2 hr. lecture, 10 hr. lab)

Prerequisites: Power Machinery I (MST 1117)

Competencies and Suggested Objectives:

1. Prepare the engine lathe and perform various operations on an engine lathe.
   a. Sharpen a cutoff tool blade and perform recessing and cutoff operations according to instructor specifications.
   b. Use taper formulas to calculate dimensions and perform taper turning operation according to instructor specifications.
   c. Set up and turn work between center to project specifications using and engine lathe.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7,S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
   d. Pick up an unfinished or damaged thread using an engine lathe.
2. Set up and grind an angular surface to project specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Discuss, set up, and perform operations using a drill press.
   a. Identify and describe the parts of a drill press.
   b. Describe operations performed on a drill press.
   c. Set up a drill press and perform various drilling and boring operations including countersinking, counterboring, spot-facing, reaming, tapping, and angular drilling.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
4. Set up and perform vertical milling operations according to project specifications.
   a. Perform a fly cutting operation according to project specifications.
   b. Perform a compound angling operation according to project specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Precision Layout

Course Abbreviation: MST 1613

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: An introduction to the concepts and practice of precision layout for machining operations. Includes instruction and practice in the use of layout instruments. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Identify presicion layout instruments and perform precision layout.
   a. Identify and describe the use of instruments used for precision layout including vernier height gauge, sine bar, sine plate, gauge blocks, surface plate, angle plate, and planer gauge.
   b. Perform a precision layout job using precision layout tools to blueprint specifications and tolerances and manufacture the part.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Advanced Blueprint Reading

Course Abbreviation: MST 1423

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: A continuation of Blueprint Reading with emphasis on advanced feature of technical prints. Includes instruction on the identification of various projections and views and on different assembly components. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: Blueprint Reading (MST 1413)

Competencies and Suggested Objectives:

1. Describe features related to alterations, chamfers, and knurls.
   a. Identify alterations and changes in size and specifications made on a drawing and describe how these alterations and changes are recorded.
   b. Identify and describe how chamfer is represented and dimensioned.
   c. Identify and describe how knurls are dimensioned.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Describe the use of assembly drawings.
   a. Describe the purpose of assembly drawings.
   b. Discuss and contrast the differences in assembly drawings and detail drawings.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Identify and apply the use of geometric tolerancing symbols.
   a. Identify geometric tolerancing and symbols used in blueprints.
   b. Apply geometric tolerancing and symbol interpretation to print reading.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Power Machinery III

Course Abbreviation: MST 2135

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: A continuation of the Power Machinery II course with emphasis on advanced applications of the engine lathe, milling, and grinding machine. (5 sch: 2 hr. lecture, 6 hr. lab)

Prerequisites: Power Machinery II (MST 1127)

Competencies and Suggested Objectives:

1. Calculate and fabricate various threads.
   a. Calculate bore size for various types and sizes of internal threads.
   b. Calculate dimensions for additional thread form types.
   c. Machine additional internal thread form types including acme, square, and metric.
   d. Machine additional external thread form types including acme, square, and metric.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Describe and fabricate various tapers.
   a. Describe the different types of tapers and the methods used to produce and measure them.
   b. Machine different types of internal and external tapers to specifications including Morse, Brown and Sharp, and Jarno.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Describe procedures and manufacture parts using eccentric turning.
   a. Describe the procedure for eccentric turning.
   b. Manufacture parts to specifications requiring eccentric turning.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
4. Prepare and use lathe to perform various operations.
   a. Install, set up, and use lathe accessories including workholding devices, cutting tools, and tool holders.
   b. Grind cutting tools to satisfy special job requirements.
   c. Identify, select, and use carbide cutting tools.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

5. Set up and perform horizontal milling operations according to instructor specifications.
Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Power Machinery IV

Course Abbreviation: MST 2144

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop)

Description: A continuation of Power Machinery III with emphasis on highly advanced operations on the radial arm drill, milling machine, engine lathe, and precision grinder. (4 sch: 2 hr. lecture, 4 hr. lab)

Prerequisites: Power Machinery III (MST 2135)

Competencies and Suggested Objectives:

1. Identify types of gears and manufacture parts using indexing.
   a. Identify the various types of gears including spur, helical, bevel, and herringbone.
   b. Manufacture parts to specifications using direct, simple, and angular indexing.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Describe, select grind wheels, and use grinding machinery.
   a. Describe precision grinding operations to include cylindrical (external and internal), centerless, and tool and cutter grinding.
   b. Recognize and use standard grinding machine safety precautions.
   c. Identify, select, install, and use the different types of grinding wheels for various precision grinding operations.
   d. Set up and grind milling machine cutters to include plain milling cutters, helical milling cutters, and end mills.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Identify and discuss applications for sinker type electrical discharge machine technology.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7,S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

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Course Name: Computer Numerical Control Operations I

Course Abbreviation: MST 2714

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop, Tool and Die Making)

Description: An introduction to the application of computer numerical control (CNC) and computer assisted manufacturing (CAM) techniques and practices. Includes instruction and practice related to the use of the Cartesian coordinate system, programming codes and command, and tooling requirements for CNC/CAM machines. (4 sch: 3 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Describe CNC machining and uses, and applications of CNC program.
   a. Describe the capabilities and limitations of computer numerical control (CNC)/computer assisted manufacturing (CAM) equipment.
   b. Describe the Cartesian coordinate system as used in a CNC machine program.
   c. Describe the differences in absolute and incremental dimensioning as related to an ISO programming of a CNC machine.
   d. Describe procedures for CNC machine start-up including program input procedures.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. List and describe commands for CNC machine codes.
   a. List and describe the purpose or function of the preparatory commands for a CNC machine (G-codes).
   b. List and describe the purpose or function of the miscellaneous commands used with a CNC machine (M-codes).
   c. List and describe the purpose of other alphabetical commands used in programming operations of a CNC machine.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Describe and select tool for CNC operations and use CNC mill, CNC lathe, and CNC machine centers to project specifications.
   a. Describe the different types of tooling required for CNC mills, CNC lathes, and CNC machine centers.

b. Select proper tooling required for a specific job on a CNC mill, CNC machine centers, and CNC lathe.
c. Write and manually input program data, to include tool offsets and radius compensation for a CNC machine center, CNC mill, and CNC lathe.
d. Execute programs for CNC mill, CNC lathe, and CNC machine center according to project specifications.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Computer Numerical Control Operations II

Course Abbreviation: MST 2725

Classification: Vocational-Technical Core (Machine Tool Operation/Machine Shop, Tool and Die Making)

Description: A continuation of Computer Numerical Control Operations I. Includes instruction in writing and editing CNC programs, machine setup and operation, and use of CAM equipment to program and operate CNC machines (CNC lathes, CNC mills, CNC machine centers, and wire EDM). (5 sch: 2 hr. lecture, 6 hr. lab)

Prerequisites: Computer Numerical Control Operations I (MST 2714)

Competencies and Suggested Objectives:

1. Write, change, and interface CNC machine programs to specifications.
   a. Describe and perform procedures for editing, altering, inserting, and deleting steps in a CNC program using computer aided design, CMA, and internal machine control unit.
   b. Write and execute CNC programs to manufacture parts to meet blueprint specifications which include the following: canned cycles, multiple repetitive cycles, sub-programs, and macros.
   c. Inspect parts manufactured by a CNC machine and adjust program to meet specifications.
   d. Use a computer assisted manufacturing (CAM) system to generate a program for a CNC machine.
   e. Interface a CAM system to a CNC machine and download a CNC program.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Set up, enter a program, and manufacture parts to specifications.
   a. Set up (mount workpiece and tooling) a CNC machine, enter program into memory, and manufacture parts to specifications and tolerances.
   b. Set up (mount workpiece and tooling) the CNC machine and execute the CAM program to manufacture parts to specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Describe and execute preventive maintenance procedures for CNC machines and wire and ram EDM.
   a. Describe preventive maintenance procedures.
   b. Lubricate, clean the machine, check coolant, and remove chip debris.

c. Dispose of materials according to acceptable standards.
Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Metallurgy

Course Abbreviation: MST 2812

Classification: Vocational-Technical Elective (Machine Tool Operation/Machine Shop and Tool and Die Making)

Description: An introduction to the concepts of metallurgy. Includes instruction and practice in metal identification, heat treatment, and hardness testing. (2 sch: 1 hr. lecture, 2 hr. lab)

Prerequisite: None

Competencies and Suggested Objectives:

1. Identify metals and methods of heat treatment of metals to include heat treating equipment.
   a. Identify different types of metals by SAE/AISI classification and describe their characteristics and uses.
   b. Describe the different methods for heat treatment of metals to include hardening, tempering, and annealing of ferrous metals.
   c. Identify heat treating equipment.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Identify and use hardness testing equipment including hardening and tempering of metals.
   a. Identify and describe the use of hardness testing equipment.
   b. Harden and temper metal to meet blueprint specifications.
   c. Perform hardness testing procedures.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Special Problem in Machine Tool Operation/Machine Shop Technology

Course Abbreviation: MST 291(1-3)

Classification: Vocational-Technical Elective (Machine Tool Operation/Machine Shop)

Description: A course designed to provide the student with practical application of skills and knowledge gained in other Machine Tool Operation/Machine Shop courses. The instructor works closely with the student to insure that the selection of a project will enhance the student's learning experience. (1-3 sch: 2-6 hr. lab)

Prerequisites: Minimum of 12 sch Machine Tool Operation/Machine Shop related courses

Competencies and Suggested Objectives:

1. Develop a written plan which details the activities and projects to be completed.
   a. Utilize a written plan which details the activities and projects to be completed.
   b. Perform written occupational objectives in the special problem.
   Related Academic Topics (See Appendix A): C5,C6
   Workplace Skills (See Appendix B): WP1, WP6
2. Assess accomplishment of objectives.
   a. Prepare a daily written assessment of accomplishment of objectives.
   b. Present weekly written reports to instructor in activities performed and objectives accomplished.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1, WP6
3. Utilize a set of written guidelines for the special problem.
   a. Develop a set of written guidelines for the special problem.
   b. Follow the guidelines throughout the project development.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1, WP6

Course Name: Work-Based Learning in Machine Tool Operation/Machine Shop Technology

Course Abbreviation: MST 292(1-6)

Classification: Vocational-Technical Elective (Machine Tool Operation/Machine Shop)

Description: This course is a cooperative program between industry and education and is designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours. (1-6 sch: 3-18 hr. internship)

Prerequisites: Consent of instructor and the completion of at least one semester of advanced course work in the Machine Tool Operation/Machine Shop

Competencies and Suggested Objectives:

1. Apply technical skills needed to be a viable member of the work force.
   a. Prepare a description of technical skills to be developed in the work-based learning program.
   b. Develop technical skills needed to be a viable member of the work force.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1
2. Apply skills developed in other program area courses.
   a. Perform skills developed in other program area courses in the work-based learning program.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5, WP6
3. Apply human relationship skills.
   a. Interact positively in the work-based learning program to demonstrate interpersonal skills.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP3
4. Apply and practice positive work habits and responsibilities.
   a. Perform assignments to develop positive work habits and responsibilities.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP3
5. Work with instructor and employer to develop written occupational objectives to be accomplished.
   a. Perform written occupational objectives in the work-based learning program.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP6

6. Assess accomplishment of objectives.
   a. Prepare daily written assessment of accomplishment of objectives.
   b. Present weekly written reports to instructor in activities performed and objectives accomplished.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP6
7. Utilize a set of written guidelines for the work-based learning program.
   a. Develop and follow a set of written guidelines for the work-based learning program.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP6

TOOL AND DIE MAKING TECHNOLOGY COURSES

Course Name: Fundamentals of Die Making

Course Abbreviation: TDT 1113

Classification: Vocational-Technical Core (Tool and Die Making)

Description: Introduction to tool and die making procedures including an orientation to metallurgy, die making, and instruction in the practice of die fabrication. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Identify the basic parts of an elementary die and metals used in fabrication of dies.
   a. Define the role of die sets in industry.
   b. Identify and describe the use of different metals used in die fabrication to include hot rolled, cold rolled, and tool.
   c. Describe the basic parts of an elementary die to include die block, punches, punch retainer, stripper, and stop.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Describe the use and maintenance of carbide and diamond tipped tools in die making equipment.
   a. Distinguish between fixed and replaceable cutting tips.
   b. Describe design requirements for carbide and diamond tipped tools.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Describe the three cortical stages of shearing action on metals.
   a. Determine cutting clearances between die and punch for different types of materials (brass, aluminum, steels, etc.).
   b. Describe factors which affect the life of a die.
   c. Explain and demonstrate processes of slug and scrap elimination.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
4. Fabricate, harden, temper, and test tool steel die components to a specified Rockwell hardness.
   a. Describe procedures for heat treatment of die components to include hardening, tempering, and annealing ferrous metals.

b. Finish hardened die components to include finish grinding, lapping dowel holes, and cleaning out threads.

Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

Workplace Skills (See Appendix B): WP2, WP3, WP5, WP

Course Name: Die Repair

Course Abbreviation: TDT 1123

Classification: Vocational-Technical Core (Tool and Die Making)

Description: An introduction to the repair and maintenance of industrial dies, including practice using industrial dies. (3 sch: 1 hr. lecture 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Determine safe and proper handling of a die to include opening, identifying, and analyzing failure of a die.
   a. Determine safe and proper handling and support procedures based on weight and size.
   b. Identify and describe the different types of failures which can occur in dies.
   c. Open die; analyze and determine cause of failure.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Disassemble, repair, and reassemble die for tryout.
   a. Disassemble and correct failure to include making, sharpening, or replacing die components.
   b. Check clearances, realign, and redowel.
   c. Recondition a die set to hold the repaired die.
   d. Set up die in punch press for tryout.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

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Course Name: Die Design I

Course Abbreviation: TDT 1133

Classification: Vocational-Technical Core (Tool and Die Making)

Description: This course is an introduction into the design of industrial dies which includes instruction and practice in calculations and processes of die design. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Describe the basic types of die design and characteristics.
   a. Describe the basic types of die designs and the advantages and disadvantages of each.
   b. Identify and describe the use of the different types of die sets used for mounting dies.
   c. Describe the characteristics of the different types of industrial dies to include progressive, compound, and multistage dies.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Sketch a die showing its components and strip layout.
   a. Sketch a die showing its components.
   b. Do a strip layout and calculate the advance for a progressive die.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Make required calculations for die fabrications.
   a. Calculate cutting clearances, shut height, bend allowance, developed. length, offset displacement, blanking tonnage, stripping pressures, spring pressure, and number of springs.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3,WP5, WP6
4. Select, describe, and determine procedures obtaining die-to-press relationship.
   a. Describe and demonstrate procedures for obtaining correct die-to-press relationship.
   b. Select a die set to fit a given punch press.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Die Making I

Course Abbreviation: TDT 1144

Classification: Vocational-Technical Core (Tool and Die Making)

Description: This course is designed to present die making procedures which includes instruction and practice in fabrication, heat treatment, and finishing dies. (4 sch: 1 hr. lecture, 6 hr. lab)

Prerequisites: Fundamentals of Die Making (TDT 1113)

Competencies and Suggested Objectives:

1. Identify and describe the various components of a blanking die.
   a. Identify and describe the use of various punches, stops, pilots, and locators.
   b. Identify and describe the use of various die blocks.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Fabricate die components to specifications.
   a. Machine punches to specifications for a blanking die.
   b. Fabricate die blocks to specifications.
   c. Heat treat and test components to specified hardness.
   d. Finish grind, clean, and inspect components to meet specifications.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
3. Assemble and try out blanking die.
   a. Mount components to die set.
   b. Set up blanking die in punch press and try out.
   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Die Design II

Course Abbreviation: TDT 2153

Classification: Vocational-Technical Core (Tool and Die Making)

Description: This course is a continuation of Die Design I which includes instruction and practice in designing different types of dies used in industry. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: Die Design I (TDT 1133)

Competencies and Suggested Objectives:

1. Design various dies and select proper tool steel for fabrication.
   a. Design bending dies.
   b. Design combination dies.
   c. Design multi-stage progressive dies.
   d. Design compound dies.
   e. Select tool steel for specific die applications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Describe CAD/CAM as it applies to die design.
   a. Describe applications of the CAD/CAM system to die design.
   b. Create a die design using CAD/CAM.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5,S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Die Making II

Course Abbreviation: TDT 2164

Classification: Vocational-Technical Core (Tool and Die Making)

Description: This course is a continuation of Die Making I with emphasis on fabrication of complex types of dies. (4 sch: 1 hr. lecture, 6 hr. lab)

Prerequisites: Die Making I (TDT 1144)

Competencies and Suggested Objectives:

1. Fabricate progressive die components.
   a. Machine various materials to stop to specifications.
   b. Machine piercing die block to specifications.
   c. Fabricate cutoff die block to specifications.
   d. Machine cutoff and form punch to specifications.
   e. Machine solid stripper to specifications.
   f. Fabricate spring pressure pad.
   g. Heat treat, test, assemble, install, and try out a progressive die.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Compare and contrast EDM fabrication to conventional fabrication procedures for die making.
   a. Contrast traditional die making procedures to procedures used with electrical discharge machines.
   b. Describe uses and applications of an EDM machine.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Die Making III

Course Abbreviation: TDT 2174

Classification: Vocational-Technical Core (Tool and Die Making)

Description: This course is designed as a continuation of Die Making II which includes instruction and practice in fabrication of compound dies and the use of computerized traveling wire electrical discharge machine. (4 sch: 2 hr. lecture, 4 hr. lab)

Prerequisite: Die Making II (TDT 2164)

Competencies and Suggested Objectives:

1. Describe WEDM application and fabricate a compound die.
   a. Describe WEDM machine setups, procedures, power supply settings, and correct flushing methods.
   b. Describe programming of a computerized traveling wire electrical discharge machine.
   c. Set up and orientate part to machine.
   d. Contour cut die blocks, punches, stripper, and slug clearances with computerized traveling wire EDM machine.
   e. Fabricate, assemble and mount, and try out a compound die made with a computerized EDM machine.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7,S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Computer Numerical Control Operations III

Course Abbreviation: TDT 2233

Classification: Vocational-Technical Core (Tool and Die Making)

Description: This course is designed as a continuation of Computerized Numerical Operations II with special emphasis on die making operations. The course includes instruction and practice in the use of the traveling wire electrical discharge machine (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisite: Computer Numerical Control Operations II (MST 2714)

Competencies and Suggested Objectives:

1. Generate a CAD/CAM program for operating a traveling WEDM and machine various die components.
   a. Generate a program for a computerized traveling wire EDM using CAD/CAM.
   b. Interface CAD/CAM to a computerized traveling wire EDM.
   c. Describe machine flushing, filtration, and maintenance procedures.
   d. Set up the computerized traveling wire EDM and download a program from CAD/CAM.
   e. Machine contours for various die components and tools to specifications using CAD/CAM and computerized traveling wire EDM.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6
   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

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Course Name: Jigs, Fixtures, and Tools

Course Abbreviation: TDT 2183

Classification: Vocational-Technical Elective (Tool and Die Making Technology)

Description: This course is designed to provide students with specialized skills associated with the design and fabrication of work holding devices including jigs, fixtures and other tools. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Describe and design basic jig and fixture components.
   a. Identify and describe clamps, drill bushings, gauges, and feet.
   b. Design drill jigs to meet part specifications.
   c. Design a work holding fixture to meet job specifications.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6
2. Fabricate, heat treat, and test drill jig and work holding fixture.
   a. Fabricate and try out a drill jig.
   b. Fabricate and try out a work holding fixture.
   c. Heat treat components and test to specified hardness.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, C6, M1, M2, M3, M4, M5, M6, M7, S4, S5, S6

   Workplace Skills (See Appendix B): WP2, WP3, WP5, WP6

Course Name: Special Problem in Tool and Die Making Technology

Course Abbreviation: TDT 291(1-3)

Classification: Vocational-Technical Elective (Tool and Die Making)

Description: A course designed to provide the student with practical application of skills and knowledge gained in other Tool and Die Making courses. The instructor works closely with the student to insure that the selection of a project will enhance the student's learning experience. (1-3 sch: 2-6 hr. lab)

Prerequisites: Minimum of 12 sch Tool and Die Making

Competencies and Suggested Objectives:

1. Develop a written plan which details the activities and projects to be completed.
   a. Utilize a written plan which details the activities and projects to be completed.
   b. Perform written occupational objectives in the special problem.
   Related Academic Topic (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1, WP6
2. Assess accomplishment of objectives.
   a. Prepare a daily written assessment of accomplishment of objectives.
   b. Present weekly written reports to instructor in activities performed and objectives accomplished.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1, WP6
3. Utilize a set of written guidelines for the special problem.
   a. Develop a set of written guidelines for the special problem.
   b. Follow the guidelines throughout the project development.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1, WP6

Course Name: Work-Based Learning in Tool and Die Making Technology

Course Abbreviation: TDT 292(1-6)

Classification: Vocational-Technical Elective (Tool and Die Making)

Description: This course is a cooperative program between industry and education and is designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hour. (1-6 sch: 3-18 hr. internship)

Prerequisites: Consent of instructor and the completion of at least one semester of advanced course work in the Tool and Die Making program.

Competencies and Suggested Objectives:

1. Apply technical skills needed to be a viable member of the work force.
   a. Prepare a description of technical skills to be developed in the work-based learning program.
   b. Develop technical skills needed to be a viable member of the work force.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP1
2. Apply skills developed in other program area courses.
   a. Perform skills developed in other program area courses in the work-based learning program.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5, WP6
3. Apply human relationship skills.
   a. Interact positively in the work-based learning program to demonstrate interpersonal skills.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP3
4. Apply and practice positive work habits and responsibilities.
   a. Perform assignments to develop positive work habits and responsibilities.
   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP3
5. Work with instructor and employer to develop written occupational objectives to be accomplished.
   a. Perform written occupational objectives in the work-based learning program.
   Related Academic Topics (See Appendix A) C5, C6
   Workplace Skills (See Appendix B): WP6
6. Assess accomplishment of objectives.
   a. Prepare daily written assessment of accomplishment of objectives.

b. Present weekly written reports to instructor activities performed and objectives accomplished.

Related Academic Topics (See Appendix A): C5, C6
Workplace Skills (See Appendix B): WP6

7. Utilize a set of written guidelines for the work-based learning program.

Related Academic Topics (See Appendix A): C5, C6
Workplace Skills (See Appendix B): WP6

RELATED VOCATIONAL-TECHNICAL COURSES

Course Name: Fundamentals of Drafting

Course Abbreviation: DDT 1114

Classification: Related Vocational-Technical (From Drafting and Design Technology)

Description: Course designed to give drafting majors the background needed for all other drafting courses. (4 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Discuss classroom procedures and drafting occupations.
   a. Describe proper classroom/lab procedures.
   b. Describe the various occupations in drafting and their requirements.
   Related Academic Topics (See Appendix A): C2, C5, C6
   Workplace Skills (See Appendix B): WP2, WP5, WP6
2. Explain and apply safety rules and regulations.
   a. Describe safety rules for drafting occupations.
   b. List and discuss hazardous materials found in the drafting area.
   Related Academic Topics (See Appendix A): C2, C5, C6
   Workplace Skills (See Appendix B): WP2, WP5, WP6
3. Demonstrate the ability to apply proper techniques in instrument drawings.
   a. Demonstrate the ability to scale drawings.
   b. Construct various angles.
   c. Recognize and construct the different types of lines.
   Related Academic Topics (See Appendix A): C2, C5, C6
   Workplace Skills (See Appendix B): WP2, WP5, WP6
4. Demonstrate the ability to sketch and develop views of basic shapes.
   a. Develop a pictorial view from three principal views.
   b. Develop three principal views from a pictorial view.
   c. Complete three principal views when lines are missing.
   Related Academic Topics (See Appendix A): C2, C5, C6
   Workplace Skills (See Appendix B): WP2, WP5, WP6
5. Demonstrate the ability to use geometric constructions.
   a. Construct tangent arcs and lines.
   b. Divide lines or arcs into equal and/or proportional parts.
   c. Develop geometric shapes.
   Related Academic Topics (See Appendix A): C2, C5, C6
   Workplace Skills (See Appendix B): WP2, WP5, WP6
6. Demonstrate the ability to construct orthographic projections.
   a. Construct a top view, with front and right side views given.
   b. Construct a front view, with top and right side views given.

c. Construct a right side view, with top and front views given.

Related Academic Topics (See Appendix A): C2, C5, C6

Workplace Skills (See Appendix B): WP2, WP5, WP6

7. Demonstrate the ability to dimension objects.
   a. Recognize lines, symbols, features, and conventions used in dimensioning.
   b. Recognize and use size and location dimensions.
   c. Recognize and use general and local notes.
   d. Dimension a drawing using contour, chain, and baseline dimensioning.

   Related Skills (See Appendix A): C2, C5, C6

   Workplace Skills (See Appendix B): WP2, WP5, WP6
8. Demonstrate the ability to construct sectional views.
   a. Construct full and half sectional views.
   b. Recognize and construct removed, revolved, offset, and aligned sectional views.

   Related Academic Topics (See Appendix A): C2, C5, C6

   Workplace Skills (See Appendix B): WP2, WP5, WP6

Course Name: Systems Programming I

Course Abbreviation: EET 1613

Classification: Related Vocational-Technical (From Electricity/Electronics/Related Engineering Cluster)

Description: This course introduces the student to basic computer science as used in electricity/electronics areas. Computer nomenclature, logic, numbering systems, coding, operating system commands, editing, and batch files are covered. (This course may be substituted for Fundamentals of Microcomputer Applications [CPT 1114].) (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Demonstrate the essentials of microcomputer components.
   a. Describe the types and functions of power supplies.
   b. Demonstrate the use of motherboard/UP and computer environment.
   c. Describe the types and use of floppy disc drives.
   d. Discuss the uses of motherboard memory/numbering systems-Kilo and Meg.
   e. Define motherboard expansion slots.
   f. Demonstrate the power on self test.
   g. Demonstrate motherboard replacement and set-up.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5, WP6
2. Demonstrate an understanding of essential microcomputer peripherals.
   a. Describe keyboard-input data.
   b. Demonstrate the use of the mouse.
   c. Describe the procedures for the operation of the printer.
   d. Prepare a modem and make a call to an outside phone.
   e. Write and read to and from hard drive.
   f. Write and read to and from a floppy drive.
   g. Connect video monitors and adapters.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP6
3. Demonstrate an understanding of essential microcomputer operating systems.
   a. Define DOS and its application.
   b. Operate a PC using DOS commands.
   c. Explain DOS files, file management, disk management, line editor, utilities, and technical aspects.
   d. Demonstrate how to make revisions using DOS utilities.

Related Academic Topics (See Appendix A): C5, C6
Workplace Skills (See Appendix B): WP5, WP6

4. Demonstrate an understanding of essential microcomputer architecture.
   a. Define microcomputer architecture.
   b. Identify major differences of:
      (1) Work length.
      (2) Size of directly addressable memory.
      (3) Micro-processor speed.
   c. Draw and label a block diagram of a typical architecture indicating all major components.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP6
5. Create a batch file.
   a. Create a batch file to clean screen and:
      (1) Display messages.
      (2) Display current directory.
      (3) Display the contents of a user selected directory.
      (4) Direct a file to a printer.
   b. Create on auto-exec.BAT to clear screen and:
      (1) Display a message.
      (2) Change DOS Prompt to display wither date or current history.
      (3) Call batch file created in step 1.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5, WP6
6. Use editing, debugging techniques.
   a. Debug a faulty batch file.
   b. Edit a faulty batch file.
   c. Debug a faulty AUTO EXEC batch file.
   d. Edit a faulty AUTO EXEC batch file.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5, WP6
7. Set and up configure a microcomputer using operating system.
   a. Set up a DOS path for three sub-directories.
   b. Develop a configuration system file which creates a selected number of buffers and files assigned.
   c. Create a RAM drive (Virtual disk).
   d. Generate two sub-directories in the RAM drive and transfer the two files from a floppy drive to the RAM drive.

   Related Academic Topics (See Appendix A): C5, C6
   Workplace Skills (See Appendix B): WP5
8. Demonstrate competency with a graphic operating system.
   a. Complete the following tasks using a windows driven operation system:
      (1) Format a disk.
      (2) Save files to disk.

(3) Read files to disk.
(4) Change colors of window borders.
(5) Install a program and assign an icon.
(6) Perform word processing using a windows driven word processor.

Related Academic Topics (See Appendix A): C5, C6
Workplace Skills (See Appendix B): WP3, WP6

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Course Name: Fundamentals of Microcomputer Applications

Course Abbreviation: CPT 1113

Classification: Related Vocational-Technical (From Business and Office and Related Technology Programs)

Description: This course will introduce information processing concepts to include: word processing, spreadsheet, and database management software. **Service course; not to be taken by Business and Office and Related Technology Students.** (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Discuss hardware components.
   a. Describe the input, output, and storage elements of the information processing cycle and explain each element.
   b. Describe and discuss the three main classifications of the computer to included micro, mid-range, and mainframes.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M1, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP6
2. Explain classes of software.
   a. Describe functions of systems software.
   b. Identify widely used software applications.
   c. Discuss various high level languages.
   d. Discuss data organization.

   Related Academic Topics (See Appendix A): C1, C2, C3, C4, C5, M1, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP6
3. Create and print mailable documents.
   a. Develop keyboarding skills.
   b. Prepare letters using full block style.
   c. Use word processing software to product documents.

   Related Academic Topics (See Appendix A): C1, C2 C3, C4, C5, M1, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP6
4. Create and print spreadsheet.
   a. Use spreadsheet software to produce acceptable worksheets.
   b. Generate graphs from worksheets.

   Related Academic Topics (See Appendix A): C1, C2, C4, C5,M1, M7, S8
   Workplace Skills (See Appendix B): WP2, WP4, WP6
5. Create and print database files.
   a. Use database software to product databases.
   b. Edit database records.

c. Print reports.

Related Academic Topics (See Appendix A): C1, C2, C4, C5, M1, M7, S8
Workplace Skills (See Appendix B): WP2, WP4, WP6

6. Integrate application information.
   a. Merge a database with a word processing letter.
   b. Merge a spreadsheet with a letter.

Related Academic Topics (See Appendix A): C1, C2, C4, C5, M1, M7, S8
Workplace Skills (See Appendix B): WP2, WP4, WP6

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Course Name: Principles of CAD

Course Abbreviation: DDT 1313

Classification: Related Vocational-Technical (From Drafting and Design Technology)

Description: This course will introduce the student to the operating system and how to perform basic drafting skills on the CAD. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Demonstrate the ability to manage the operating system.
   a. Format, label, and examine the contents of floppy disks.
   b. List, erase, rename, and copy files on floppy and hard disks.
   c. Create, remove, and move files between directories and subdirectories.
   d. Set the date and time on the computer.
   e. Examine the contents of files.

   Related Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5, M7, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6
2. Demonstrate the ability to use the basic hardware of the CAD system.
   a. Input data using keyboard, graphics tablet, and mouse.
   b. Access files and/or symbols from the hard disk.
   c. Store, retrieve, copy, and delete drawing and files.

   Related Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5, M7, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6
3. Demonstrate the ability to perform drafting functions on the CAD system.
   a. Construct a drawing using the draw command.
   b. Product a drawing utilizing the construct command.
   c. Utilize the modify commands.
   d. Utilize the setting variables.

   Related Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5 M7, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6

Course Name: Descriptive Geometry

Course Abbreviation: DDT 1153

Classification: Related Vocational-Technical (From Drafting and Design Technology)

Description: Theory and problems designed to develop the ability to visualize points, lines, and surfaces of space. (3 sch: 1 hr. lecture, 4 hr. lab)

Prerequisites: Fundamentals of Drafting (DDT 1114)

Competencies and Suggested Objectives:

1. Demonstrate the ability to develop views.
   a. Read and analyze a multi-view drawing by lines and surfaces.
   b. Construct top, front, and auxiliary adjacent views.

   Relate Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5, M7, S8

   Workplace Skills (Appendix B): WP2, WP5, WP6
2. Demonstrate the ability to solve problems of spatial relationships.
   a. Locate points and lines in space.
   b. Find true lengths and slopes of a lines.
   c. Recognize parallel, intersecting, and perpendicular lines and solve problems relative to each.
   d. Draw lines in a prescribed direction.
   e. Derive an axonometric view.
   f. Locate points and lines in a plane.
   g. Solve slope, strike, and true size of plane problems.

   Related Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5, M7, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6
3. Demonstrate the ability to solve problems of lines, planes, and angle.
   a. Determine the intersection of a line and plane.
   b. Determine the intersection of two planes.
   c. Solve problems involving dihedral angles.
   d. Solve a basic revolution of a line and point problem.
   e. Solve problems involving the intersection of two prisms, a cylinder and a prism, and a cone and a cylinder.

   Related Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5, M7, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6

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Course Name: Quality Assurance

Course Abbreviation: DDT 2263

Classification: Related Vocational-Technical (From Drafting and Design Technology)

Description: The application of statistics and probability theory in quality assurance programs. Various product sampling plans will be studied as well as the development of product charts for defective units. (3 sch: 2 hr. lecture, 2 hr. lab)

Prerequisites: None

Competencies and Suggested Objectives:

1. Demonstrate the ability to utilize basic quality assurance procedures.
   a. Discuss the history and development of quality assurance and the use of quality circles.
   b. Describe the concept of probability.
   c. Compute the following measures of central tendency: mean, median, and mode for a given data set.
   d. Describe the frequency distribution for a normal population.
   e. Distinguish between the terms "accuracy," "precision," and "accuracy and precision."
   f. Compute the standard deviation and the square of the residuals for a given set of data.

   Related Academic Topics (See Appendix A): C2, C3, C5, M2, M3, M5, M7, S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6
2. Demonstrate the ability to effectively use sampling techniques.
   a. Describe the process of random sampling as applied to quality assurance.
   b. Compare single and multiple sampling plans.
   c. Describe the characteristics of the Mil. Std. 105D sampling plan.
3. Demonstrate the ability to effectively use various charts.
   a. Describe the general theory of a control chart.
   b. Describe the development and use of fraction defective charts in quality assurance.
   c. Discuss special applications of control charts in quality assurance.
   d. Apply quality assurance methods in a laboratory setting.

   Related Academic Topics (See Appendix A): C2, C3, C5, C6, M2, M3, M5, M7,S8

   Workplace Skills (See Appendix B): WP2, WP5, WP6

RELATED ACADEMIC COURSES

July 30, 1996

Course Name: Trigonometry

Course Abbreviation: MAT 1323

Classification: Related Academic

Description: Trigonometric functions; functions of the composite angle; fundamental relations; trigonometric equations; logarithms; radian measure; solution of right and oblique triangles, inverse trigonometric functions; and vectors.

Prerequisite: College Algebra (MAT 1313)

SECTION III:

RECOMMENDED TOOLS AND EQUIPMENT

RECOMMENDED TOOLS AND EQUIPMENT FOR MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

1. Lathes with accessories including digital readout (15)
   13" or 14" (9)
   15" x 60" (2)
   15" x 48" (2)
   17" X 72" (2)
2. Vertical mills:: 9" x 42" bed with accessories including digital readout (5)
3. Horizontal mill (1)
4. Surface grinder, automatic w/magnetic chuck and accessories (2)
5. Vertical bank saw - 20" (1)
6. Horizontal band saw - 10" (1)
7. Drill press -20" minimum (with accessories) (1)
8. Hydraulic press - 50 ton (1)
9. CNC lathe mill (CNC vertical mill, CNC Machine Center, WEDM w/complete tooling) (1 each)
10. Pedestal grinders (10" and 12") (2)
11. Air compressor (1)
12. Blade welder (band saw) (1)
13. Work benches (6)
14. Vises (6") (6)
15. Dividing head, wide range (1)
16. Rotary table (1)
17. Sets of drills (taper shank) (2)
18. Set of taper shank reamer (1)
19. Computers w/software (CAM) (10)
20. Printers (5)
21. Post grinder tool (1)
22. Height gauge (electronic & conventional) (1)
23. Surface plate - 24" x 36" (1)
24. Boring head and boring bar set for vertical mill (5)
25. Cutting torch set w/cart (1)
26. Welding machine w/accessories (1)
27. Arbor press (5 tons) (1)
28. Safety glass cabinet with safety glasses (1)
29. TV and VCR combination (1)
30. AV cart (1)
31. Teacher desks and chairs (2)
32. Filing cabinet (1)
33. Bookcase (1)
34. Drill set (3 in 1 set) 1/16 - ½" by 64ths, A-Z, and #1 - #60 (1)
35. High speed steel drill and counter drill x 60 degrees - 5 piece set - #1 - #6 (1)

36. High speed steel: 6 flute countersink 82 degrees - 8 piece set (1/8" -1"'0) (1)
37. Hand reamers set: 1/8' - ½" by 1/64ths (1)
38. Tap and die set: - high speed steel - 1/4 -20 through 9/16 - 18 (1)
39. Metric screw pitch gage, Acme screw pitch gage, 60 degrees - V-sharp screw pitch gage (1 each)
40. Radial arm drill press (1)
41. Set end mill high speed steel 1/8" - 3/4" by 1/16 - 2 flute - center cut (double end) (1)
42. Single end ball end mill (1/8" through 3/4" by 1/8") (1)
43. Keyway broach set - 1/8" through 3/8" (1)
44. Horizontal milling cutter (set) per machine specifications (1)
45. Boring head with C.T. boring bar set (per machine specifications) for horizontal mill (1)
46. Abrasive (shop roll) - 1' wide x 100 grit, 180 grit, 220 grit (1 each) (1)
47. Buffing wheel and buffing compound (1)
48. Bench grinders (6") (2)
49. Surface grinder (wheels) to machine specifications (10)
50. Bench grinder wheels (6)
51. Wheel dressing stick (1)
52. Grinder wheel dresser (1)
53. Cluster diamond and holder for surface grinder and diamonds (1)
54. Radius angle dresser, for surface grinder and diamonds (1)
55. Micrometers: 10 @ 0" - 1"; 5 @ 1" - 2"; 2 @ 2" - 3"; and 2 @ 3" - 4" (19)
56. Depth micrometers: 2 @ 0" - 6" (2)
57. Vernier calipers: 6" (2)
58. Dial calipers: 6" (6)
59. Digital caliper: 6" (1)
60. Set of gage telescopic 5/16" - 6" - 6 piece (3)
61. Set small hole: 1/8" - ½" - 4 piece set (3)
62. Dial indicators with magnetic based and 1" travel (10)
63. Sets - test indicators and surface gages (2)
64. Gage block set (rectangular) (1)
65. Angle plates (6"x6" and 3"x3") (2)
66. "V" block set (2)
67. Sine bar - 5" sine chuck (1)
68. Precision grinding vise - 4" (2)
69. Set steel parallel (10 pieces) 1/8" (2)
70. Combination square set (4 pieces) 4R graduation with 12" blades (10)
71. Set precision square set (4 pieces) (1)
72. Scales 6" 4R graduation (20)
73. Drill point gage (1)
74. Radius gage set (4)
75. Acme thread gage set (10)

76. Center gages (10)
77. Spring calipers: inside, outside, and hermaphrodite - 3" x 6" (2)
78. Dividers - 3" and 6" (2)
79. Edge finders (electronic & conventional) (3)
80. Level precision -12" (1)
81. Trammel points (1)
82. Metal scribes (10)
83. Set, punch center, 8 piece (3)
84. Set, punch drive pin, 8 piece set (4" long) (3)
85. Combination wrench set (1)
86. Set (21 pieces) ½" drive socket set (1)
87. Set of pliers (1 set slip point, 1 set needlenose, 1 set vise grip) (1)
88. Set, pipe wrench (8", 10", 12") (1)
89. Set, adjustable wrench (6", 10", 12") (1)
90. 25' power lock tape (1)
91. Screwdriver set (6 pieces) (2)
92. 12' power lock tape (6)
93. Demagnetizer for surface grinder files (12' power lock tape12 files with handles and file cards) (1)
94. Dead blow hammers (6)
95. Ball peen hammers (6)
96. Pistol pump oilers (6)
97. Grease gun (1)
98. Sets, Allen wrenches (2 metric and 2 English) (2)
99. C-clamps - 6" (6)
100. Set, steel stamp(numbers and letters) (1)
101. Electrical engraver (1)
102. Retractable air hoses and reels (3)
103. 4" disk grinder (1)
104. Air pressure regulator (1)
105. Drill motors (3/8") (1)
106. Drill motor (½") (1)
107. Shop vacuum (wet and dry) (1)
108. Wheel dolly (4 wheels) heavy duty (1)
109. Hack saws w/blades (6)
110. Heat treating furnace (1)
111. Tempering furnace (1)
112. Quenching tank (1)
113. RAM type EDM (1)
114. Easy track mill w/tooling (1)
115. Compound angle vise (1)
116. Set Woodcraft key seat cutter (1)

RECOMMENDED TOOLS AND EQUIPMENT FOR TOOL AND DIE MAKING TECHNOLOGY

1. Lathes with accessories including digital readout (8)
   13" or 14 (7)
   15" x 60" (2)
   15" x 48" (1)
   17" X 72" (2)
2. Vertical mills:: 9" x 42" bed with accessories including digital readout (5)
3. Horizontal mill (1)
4. Surface grinder, automatic w/magnetic chuck and accessories (5)
5. Vertical bank saw - 20" (1)
6. Horizontal band saw - 10" (1)
7. Drill press -20" minimum (with accessories) (3)
8 Hydraulic press - 50 ton (1)
9. CNC lathe mill (10" and 12") (CNC vertical mill, CNC Machine Center, WEDM w/complete tooling) (1)
10. Pedestal grinders (3)
11. Air compressor (1)
12. Blade welder (band saw) (1)
13. Work benches (6)
14. Vises (6") (6)
15. Dividing head, wide range (1)
16. Rotary table (1)
17. Sets of drills (taper shank) (2)
18. Set of taper shank reamer (1)
19. Computers w/software (CAM) (6)
20. Printers (3)
21. Height gauge (electronic & conventional) (1)
22. Surface plate - 24" x 36" (1)
23. Boring head and boring bar set for vertical mill (3)
24. Cutting torch set w/cart (1)
25. Welding machine w/accessories (1)
26. Arbor press (5 tons) (1)
27. Safety glass cabinet with safety glasses (1)
28. TV and VCR combination (1)
29. AV cart (1)
30. Teacher desks and chairs (2)
31. Filing cabinet (1)
32. Bookcase (1)
33. Drill set (3 in 1 set) 1/16 - ½" by 64ths, A-Z, and #1 - #60 (1)
34. High speed steel drill and counter drill x 60 degrees - 5 piece set - #1 - #6 (1)
35. High speed steel: 6 flute countersink 82 degrees - 8 piece set (1/8" - 1"'0) (1)

36. Hand reamers set: 1/8' - ½" by 1/64ths (1)
37. Tap and die set: - high speed steel - 1/4 -20 through 9/16 - 18 (1)
38. Metric screw pitch gage, Acme screw pitch gage, 60 degrees - V-sharp screw pitch gage (1 each)
39. Radial arm drill press (1)
40. Set end mill high speed steel 1/8" - 3/4" by 1/16 - 2 flute - center cut (double end) (1)
41. Single end ball end mill (1/8" through 3/4" by 1/8") (1)
42. Keyway broach set - 1/8" through 3/8" (1)
43. Horizontal milling cutter (set) per machine specifications (1)
44. Boring head with C.T. boring bar set (per machine specifications) for horizontal mill (1)
45. Abrasive (shop roll) - 1' wide x 100 grit, 180 grit, 220 grit (1 each) (1)
46. Buffing wheel and buffing compound (1)
47. Surface grinder (wheels) to machine specifications (10)
48. Bench grinder wheels (6)
49. Wheel dressing stick (1)
50. Grinder wheel dresser (1)
51. Cluster diamond and holder for surface grinder and diamonds (1)
52. Radius angle dresser, for surface grinder and diamonds (1)
53. Micrometers: 10 @ 0" - 1"; 5 @ 1" - 2"; 2 @ 2" - 3"; and 2 @ 3" - 4" (19)
54. Depth micrometers: 2 @ 0" - 6" (2)
55. Vernier calipers: 6" (2)
56. Dial calipers: 6" (6)
57. Digital caliper: 6" (1)
58. Set of gage telescopic 5/16" - 6" - 6 piece (3)
59. Set small hole: 1/8" - ½" - 4 piece set (3)
60. Dial indicators with magnetic base and 1" travel (10)
61. Sets - test indicators and surface gages (2)
62. Gage block set (rectangular) (1)
63. Angle plates (6"x6" and 3"x3") (6)
64. "V" block set (4)
65. Sine bar - 5" sine chuck (2)
66. Precision grinding vise - 4" (2)
67. Set steel parallel (10 pieces) 1/8" (2)
68. Combination square set (4 pieces) 4R graduation with 12" blades (10)
69. Set precision square set (4 pieces) (1)
70. Scales 6" 4R graduation (20)
71. Drill point gage (1)
72. Radius gage set (4)
73. Acme thread gage set (10)
74. Center gages (10)
75. Spring calipers: inside, outside, and hermaphrodite - 3" x 6" (2)
76. Dividers - 3" and 6" (2)

77. Edge finders (electronic & conventional) (3)
78. Level precision -12" (1)
79. Trammel points (1)
80. Metal scribes (10)
81. Set, punch center, 8 piece (3)
82. Set, punch drive pin, 8 piece set (4" long) (3)
83. Combination wrench set (1)
84. Set (21 pieces) ½" drive socket set (1)
85. Set of pliers (1 set slip point, 1 set needlenose, 1 set vise grip) (1)
86. Set, pipe wrench (8", 10", 12") (1)
87. Set, adjustable wrench (6", 10," 12") (1)
88. 25' power lock tape (1)
89. 12' power lock tape (6)
90. Screwdriver set (6 pieces) (2)
91. Demagnetizer for surface grinder files (12 files with handles and file cards) (1)
92. Dead blow hammers (6)
93. Ball peen hammers (6)
94. Pistol pump oilers (6)
95. Grease gun (1)
96. Sets, Allen wrenches (2 metric and 2 English) (2)
97. C-clamps - 6" (6)
98. Set, steel stamp (numbers and letters) (1)
99. Electrical engraver (1)
100. Retractable air hoses and reels (3)
101. 4" disk grinder (1)
102. Air pressure regulator (1)
103. Drill motors (3/8") (1)
104. Drill motor (½") (1)
105. Shop vacuum (wet and dry) (1)
106. Wheel dolly (4 wheels) heavy duty (1)
107. Hack saws w/blades (6)
108. Heat treating furnace (1)
109. Tempering furnace (1)
110. Quenching tank (1)
111. RAM type EDM (1)
112. Easy track mill w/tooling (1)
113. Compound angle vise (1)
114. Set Woodraft key seat cutter (1)
115. Hardness Tester (1)
116. Die grinders (2)

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APPENDIX A:

RELATED ACADEMIC TOPICS

APPENDIX A

RELATED ACADEMIC TOPICS FOR COMMUNICATIONS

C1 Interpret written material.
C2 Interpret visual materials (maps, charts, graphs, tables, etc.).
C3 Listen, comprehend, and take appropriate actions.
C4 Access, organize, and evaluate information.
C5 Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.
C6 Communicate ideas and information effectively using various oral and written forms for a variety of audiences and purposes.

EXPANDED TOPICS FOR COMMUNICATIONS

TOPIC C1: Interpret written material.

C1.01 Read and follow complex written directions.
C1.02 Recognize common words and meanings associated with a variety of occupations.
C1.03 Adjust reading strategy to purpose and type of reading.
C1.04 Use sections of books and reference sources to obtain information.
C1.05 Compare information from multiple sources and check validity.
C1.06 Interpret items and abbreviations used in multiple forms.
C1.07 Interpret short notes, memos, and letters.
C1.08 Comprehend technical words and concepts.
C1.09 Use various reading techniques depending on purpose for reading.
C1.10 Find, read, understand, and use information from printed matter or electronic sources.

TOPIC C2: Interpret visual materials (maps, charts, graphs, tables, etc.).

C2.01 Use visuals in written and in oral presentations.
C2.02 Recognize visual cues to meaning (layout, typography, etc.).
C2.03 Interpret and apply information using visual materials.

TOPIC C3: Listen, comprehend, and take appropriate action.

C3.01 Identify and evaluate orally-presented messages according to purpose.
C3.02 Recognize barriers to effective listening.
C3.03 Recognize how voice inflection changes meaning.
C3.04 Identify speaker signals requiring a response and respond accordingly.
C3.05 Listen attentively and take accurate notes.
C3.06 Use telephone to receive information.

C3.07 Analyze and distinguish information from formal and informal oral presentations.

TOPIC C4: Access, organize, and evaluate information.

C4.01 Distinguish fact from opinion.
C4.02 Use various print and non-print sources for specialized information.
C4.03 Interpret and distinguish between literal and figurative meaning.
C4.04 Interpret written or oral communication in relation to context and writer's point of view.
C4.05 Use relevant sources to gather information for written or oral communication.

TOPIC C5: Use written and/or oral language skills to work cooperatively to solve problems, make decisions, take actions, and reach agreement.

C5.01 Select appropriate words for communication needs.
C5.02 Use reading, writing, listening, and speaking skills to solve problems.
C5.03 Compose inquiries and requests.
C5.04 Write persuasive letters and memos.
C5.05 Edit written reports, letters, memos, and short notes for clarity, correct grammar, and effective sentences.
C5.06 Write logical and understandable statements, phrases, or sentences for filling out forms, for correspondence or reports.
C5.07 Write directions or summaries of processes, mechanisms, events, or concepts.
C5.08 Select and use appropriate formats for presenting reports.
C5.09 Convey information to audiences in writing.
C5.10 Compose technical reports and correspondence that meet accepted standards for written communications.

TOPIC C6: Communicate ideas and information using oral and written forms for a variety of audiences and purposes.

C6.01 Give complex oral instructions.
C6.02 Describe a business or industrial process/mechanism.
C6.03 Participate effectively in group discussions and decision making.
C6.04 Produce effective oral messages utilizing different media.
C6.05 Explore ideas orally with partners.
C6.06 Participate in conversations by volunteering information when appropriate and asking relevant questions when appropriate.
C6.07 Restate or paraphrase a conversation to confirm one's own understanding.
C6.08 Gather and provide information utilizing different media.

C6.09 Prepare and deliver persuasive, descriptive, and demonstrative oral presentations.

RELATED ACADEMIC TOPICS FOR MATHEMATICS

M1 Relate number relationships, number systems, and number theory.
M2 Explore patterns and functions.
M3 Explore algebraic concepts and processes.
M4 Explore the concepts of measurement.
M5 Explore the geometry of one-, two-, and three-dimensions.
M6 Explore concepts of statistics and probability in real world situations.
M7 Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

EXPANDED TOPICS FOR MATHEMATICS

TOPIC M1: Relate number relationships, number systems, and number theory.

M1.01 Understand, represent, and use numbers in a variety of equivalent forms (integer, fraction, decimal, percent, exponential, and scientific notation) in real world and mathematical problem situations.
M1.02 Develop number sense for whole numbers, fractions, decimals, integers, and rational numbers.
M1.03 Understand and apply ratios, proportions, and percents in a wide variety of situations.
M1.04 Investigate relationships among fractions, decimals, and percents.
M1.05 Compute with whole numbers, fractions, decimals, integers, and rational numbers.
M1.06 Develop, analyze, and explain procedures for computation and techniques for estimations.
M1.07 Select and use an appropriate method for computing from among mental arithmetic, paper-and-pencil, calculator, and computer methods.
M1.08 Use computation, estimation, and proportions to solve problems.
M1.09 Use estimation to check the reasonableness of results.

TOPIC M2: Explore patterns and functions.

M2.01 Describe, extend, analyze, and create a wide variety of patterns.
M2.02 Describe and represent relationships with tables, graphs, and rules.
M2.03 Analyze functional relationships to explain how a change in one quantity results in a change in another.
M2.04 Use patterns and functions to represent and solve problems.
M2.05 Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models or representations.

M2.06 Use a mathematical idea to further their understanding of other mathematical ideas.
M2.07 Apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, and business.

TOPIC M3: Explore algebraic concepts and processes.

M3.01 Represent situations and explore the interrelationships of number patterns with tables, graphs, verbal rules, and equations.
M3.02 Analyze tables and graphs to identify properties and relationships and to interpret expressions and equations.
M3.03 Apply algebraic methods to solve a variety of real world and mathematical problems.

TOPIC M4: Explore the concepts of measurement.

M4.01 Estimate, make, and use measurements to describe and compare phenomena.
M4.02 Select appropriate units and tools to measure to the degree of accuracy required in a particular situation.
M4.03 Extend understanding of the concepts of perimeter, area, volume, angle measure, capacity, and weight and mass.
M4.04 Understand and apply reasoning processes, with special attention to spatial reasoning and reasoning with proportions and graphs.

TOPIC M5: Explore the geometry of one-, two-, and three-dimensions.

M5.01 Identify, describe, compare, and classify geometric figures.
M5.02 Visualize and represent geometric figures with special attention to developing spatial sense.
M5.03 Explore transformations of geometric figures.
M5.04 Understand and apply geometric properties and relationships.
M5.05 Classify figures in terms of congruence and similarity and apply these relationships.

TOPIC M6: Explore the concepts of statistics and probability in real world situations.

M6.01 Systematically collect, organize, and describe data.
M6.02 Construct, read, and interpret tables, charts, and graphs.
M6.03 Develop an appreciation for statistical methods as powerful means for decision making.
M6.04 Make predictions that are based on exponential or theoretical probabilities.

M6.05 Develop an appreciation for the pervasive use of probability in the real world.

TOPIC M7: Apply mathematical methods, concepts, and properties to solve a variety of real-world problems.

M7.01 Use computers and/or calculators to process information for all mathematical situations.
M7.02 Use problem-solving approaches to investigate and understand mathematical content.
M7.03 Formulate problems from situations within and outside mathematics.
M7.04 Generalize solutions and strategies to new problem situations.

RELATED ACADEMIC TOPICS FOR SCIENCE

S1 Explain the Anatomy and Physiology of the human body.
S2 Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.
S3 Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.
S4 Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.
S5 Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.
S6 Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.
S7 Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance, population genetics, the structure and function of DNA, and current applications of DNA technology.
S8 Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

EXPANDED TOPICS FOR SCIENCE

TOPIC S1: Explain the Anatomy and Physiology of the human body.

S1.01 Recognize common terminology and meanings.
S1.02 Explore the relationship of the cell to more complex systems within the body.

S1.03 Summarize the functional anatomy of all the major body systems.
S1.04 Relate the physiology of the major body systems to its corresponding anatomy.
S1.05 Compare and contrast disease transmission and treatment within each organ system.
S1.06 Explore the usage of medical technology as related to human organs and organ systems.
S1.07 Explain the chemical composition of body tissue.

TOPIC S2: Apply the basic biological principles of Plants, Viruses and Monerans, Algae, Protista, and Fungi.

S2.01 Identify the major types and structures of plants, viruses, monera, algae protista, and fungi.
S2.02 Explain sexual and asexual reproduction.
S2.03 Describe the ecological importance of plants as related to the environment.
S2.04 Analyze the physical chemical and behavioral process of a plant.

TOPIC S3: Relate the nine major phyla of the kingdom animalia according to morphology, anatomy, and physiology.

S3.01 Explain the morphology, anatomy, and physiology of animals.
S3.02 Describe the characteristics, behaviors, and habitats of selected animals.

TOPIC S4: Explore the chemical and physical properties of the earth to include Geology, Meteorology, Oceanography, and the Hydrologic Cycle.

S4.01 Examine minerals and their identification, products of the rock cycle, byproducts of weathering, and the effects of erosion.
S4.02 Relate the Hydrologic Cycle to include groundwater its zones, movement, and composition; surface water systems, deposits, and runoff.
S4.03 Consider the effects of weather and climate on the environment.
S4.04 Examine the composition of seawater; wave, tides, and currents; organisms, environment, and production of food; energy, food and mineral resources of the oceans.

TOPIC S5: Investigate the properties and reactions of matter to include symbols, formulas and nomenclature, chemical equations, gas laws, chemical bonding, acid-base reactions, equilibrium, oxidation-reduction, nuclear chemistry, and organic chemistry.

S5.01 Examine the science of chemistry to include the nature of matter, symbols, formulas and nomenclature, and chemical equations.

S5.02 Identify chemical reactions including precipitation, acids-bases, and reduction-oxidation.
S5.03 Explore the fundamentals of chemical bonding and principles of equilibrium.
S5.04 Relate the behavior of gases.
S5.05 Investigate the structure, reactions, and uses of organic compounds; and investigate nuclear chemistry and radiochemistry.

TOPIC S6: Explore the principles and theories related to motion, mechanics, electricity, magnetism, light energy, thermal energy, wave energy, and nuclear physics.

S6.01 Examine fundamentals of motion of physical bodies and physical dynamics.
S6.02 Explore the concepts and relationships among work, power, and energy.
S6.03 Explore principles, characteristics, and properties of electricity, magnetism, light energy, thermal energy, and wave energy.
S6.04 Identify principles of modern physics related to nuclear physics.

TOPIC S7: Explore the principles of genetic and molecular Biology to include the relationship between traits and patterns of inheritance; population genetics, the structure and function of DNA, and current applications of DNA technology.

S7.01 Examine principles, techniques, and patterns of traits and inheritance in organisms.
S7.02 Apply the concept of population genetics to both microbial and multicellular organism.
S7.03 Identify the structure and function of DNA and the uses of DNA technology in science, industry, and society.

TOPIC S8: Apply concepts related to the scientific process and method to include safety procedures for classroom and laboratory; use and care of scientific equipment; interrelationships between science, technology and society; and effective communication of scientific results in oral, written, and graphic form.

S8.01 Apply the components of scientific processes and methods in classroom and laboratory investigations.
S8.02 Observe and practice safe procedures in the classroom and laboratory.
S8.03 Demonstrate proper use and care for scientific equipment.
S8.04 Investigate science careers, and advances in technology.
S8.05 Communicate results of scientific investigations in oral, written, and graphic form.

APPENDIX B:

WORKPLACE SKILLS

APPENDIX B
WORKPLACE SKILLS FOR THE 21ST CENTURY

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP5 Selects, applies, and maintains/troubleshoots technology.

WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

APPENDIX C:

STUDENT COMPETENCY PROFILE

STUDENT COMPETENCY PROFILE
FOR MACHINE TOOL OPERATION/MACHINE SHOP TECHNOLOGY

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

Advanced Shop Mathematics (MST 1313)

_____ 1. Solve mathematical problems related to machine shop activities.
_____ 2. Describe and apply trigonometric functions.
_____ 3. Identify properties of a circle and solve mathematics problems relating to the properties, and calculate area and volume for geometric objects.

Blueprint Reading (MST 1413)

_____ 1. Identify, describe, and apply dimensions and tolerances related to blueprints.
_____ 2. Identify, describe, and apply auxiliary views, finishes, materials, section lines, and cutting plane lines.

Power Machinery I (MST 1117)

_____ 1. Perform drilling operations.
_____ 2. Perform turning, boring, and cutting operations.
_____ 3. Mount a swivel based vise and perform milling and boring operations.
_____ 4. Perform project layout and use various precision instruments.
_____ 5. Calculate bandsaw blade length, fabricate a bandsaw blade, and install the blade on a bandsaw.
_____ 6. Identify, calculate, and fabricate threads to instructor's specifications.
_____ 7. List and describe the proper sequence for planning a job.

Power Machinery II (MST 1127)

_____ 1. Prepare the engine lathe and perform various operations on an engine lathe.
_____ 2. Set up and grind an angular surface to project specifications.
_____ 3. Discuss, set up, and perform operations using a drill press.
_____ 4. Set up and perform vertical milling operations according to project specifications.

Precision Layout (MST 1613)

_____ 1. Identify precision layout instruments and perform precision layout.

Advanced Blueprint Reading (MST 1423)

_____ 1. Describe features related to alterations, chamfers, and knurls.
_____ 2. Describe the use of assembly drawings.
_____ 3. Identify and apply the use of geometric tolerancing symbols.

Power Machinery III (MST 2135)

_____ 1. Calculate and fabricate various threads.
_____ 2. Describe and fabricate various tapers.
_____ 3. Describe procedures and manufacture parts using eccentric turning.
_____ 4. Prepare and use lathe to perform various operations.
_____ 5. Set up and perform horizontal milling operations according to instructor specifications.

Power Machinery IV (MST 2144)

_____ 1. Identify types of gears and manufacture parts using indexing.
_____ 2. Describe, select grind wheels, and use grinding machinery.
_____ 3. Identify and discuss applications for sinker type electrical discharge machine technology.

Computer Numerical Control Operations I (MST 2714)

_____ 1. Describe CNC machining and uses, and applications of CNC program.
_____ 2. List and describe commands for CNC machine codes.
_____ 3. Describe and select tool for CNC operations and use CNC mill, CNC lathes, and CNC machine centers to project specifications.

Computer Numerical Control Operations II (MST 2725)

_____ 1. Write, change, and interface CNC machine programs to specifications.
_____ 2. Set up, enter a program, and manufacture parts to specifications.
_____ 3. Describe and execute preventive maintenance procedures for CNC machines and wire and ram EDM.

Metallurgy (MST 2812)

_____ 1. Identify metals and methods of heat treatment of metals to include heat treating equipment.
_____ 2. Identify and use hardness testing equipment including hardening and tempering of metals.

Special Problem in Machine Tool Operation/Machine Shop Technology (MST 291(1-3))

_____ 1. Develop a written plan which details the activities and projects to be completed.
_____ 2. Assess accomplishment of objectives.
_____ 3. Utilize a set of written guidelines for the special problem.

Work-Based Learning in Machine Tool Operation/ Machine Shop Technology (MST 292(1-6))

_____ 1. Apply technical skills needed to be a viable member of the work force.
_____ 2. Apply skills developed in other program area courses
_____ 3. Apply human relationship skills.
_____ 4. Apply and practice positive work habits and responsibilities.
_____ 5. Work with instructor and employer to develop written occupational objectives to be accomplished.
_____ 6. Assess accomplishment of objectives.
_____ 7. Utilize a set of written guidelines for the work-based learning program.

STUDENT COMPETENCY PROFILE
FOR TOOL AND DIE MAKING TECHNOLOGY

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each course. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the program.

In the blank before each competency, place the date on which the student mastered the competency.

Fundamentals of Die Making (TDT 1113)

_____ 1. Identify the basic parts of an elementary die and meta's used in fabrication of dies.
_____ 2. Describe the use and maintenance of carbide and diamond tipped tools in die making equipment.
_____ 3. Describe the three cortical stages of shearing action on metals.
_____ 4. Fabricate, harden, temper, and test tool steel die components to a specified Rockwell hardness.

Die Repair (TDT 1123)

_____ 1. Determine safe and proper handling of a die to include opening, identifying, and analyzing failure of a die.
_____ 2. Disassemble, repair, and reassemble die for tryout.

Die Design I (TDT 1133)

_____ 1. Describe the basic types of die design and characteristics.
_____ 2. Sketch a die showing its components and strip layout.
_____ 3. Make required calculations for die fabrications.
_____ 4. Select, describe, and determine procedures obtaining die-to-press relationship.

Die Making I (TDT 1144)

_____ 1. Identify and describe the various components of a blanking die.
_____ 2. Fabricate die components to specifications.
_____ 3. Assemble and try out blanking die.

Computer Numerical Control Operations I (MST 2714)

_____ 1. Describe CNC machining and uses, and applications of CNC program.
_____ 2. List and describe commands for CNC machine codes.
_____ 3. Describe and select tool for CNC operations and use CNC mill, CNC lathe, and CNC machine centers to project specifications.

Die Design II (TDT 2153)

_____ 1. Design various dies and select proper tool steel for fabrication.
_____ 2. Describe CAD/CAM as it applies to die design.

Die Making II (TDT 2164)

_____ 1. Fabricate progressive die components.
_____ 2. Compare and contrast EDM fabrication to conventional fabrication procedures for die making.

Computer Numerical Control Operations II (MST 2725)

_____ 1. Write, change, and interface CNC machine programs to specifications.
_____ 2. Set up, enter, and manufacture parts to specifications.
_____ 3. Describe and execute preventive maintenance procedures for CNC machines and wire and ram EDM.

Die Making III (TDT 2174)

_____ 1. Describe WEDM application and fabricate a compound die.

Computer Numerical Control Operations III (TDT 2233)

_____ 1. Generate a CAD/CAM program for operating a traveling WEDM and machine various die components.

Metallurgy (MST 2812)

_____ 1. Identify metals and methods of heat treatment of metals to include heat treating equipment.
_____ 2. Identify and use hardness testing equipment including hardening and tempering of metals.

Jigs, Fixtures, and Tools (TDT 2183)

_____ 1. Describe and design basic jig and fixture components.
_____ 2. Fabricate, heat treat, and test drill jig and work holding fixture.

Special Problem in Tool and Die Making Technology (TDT 291(1-3))

_____ 1. Develop a written plan which details the activities and projects to be completed.
_____ 2. Assess accomplishment of objectives.
_____ 3. Utilize a set of written guidelines for the special problem.

Work-Based Learning in Tool and Die Making Technology (TDT 292(1-6))

_____ 1. Apply technical skills needed to be a viable member of the work force.
_____ 2. Apply skills developed in other program area courses.
_____ 3. Apply human relationship skills.
_____ 4. Apply and practice positive work habits and responsibilities.
_____ 5. Work with instructor and employer to develop written occupational objectives to be accomplished.
_____ 6. Assess accomplishment of objectives.
_____ 7. Utilize a set of written guidelines for the work-based learning program.